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(54) Title: GEL COMPOSITIONS			
(57) Abstract			
<p>Gelled ester compositions are provided. The gelled esters are obtained by mixing a suitable ester with one or more triblock copolymers, star polymers, radial polymers, multi-block copolymers, or mixtures thereof. Optionally, one or more diblock copolymers can be used in forming the gel compositions. In addition to gelled esters, gelled alcohols, gelled ethers, and gelled naturally-occurring fats and oils also are obtained by using one or more diblock copolymers, triblock copolymers, star polymers, radial polymers, multi-block copolymers, or mixtures thereof as a gelling agent. Butyl rubbers and alkyl galactomannan also can be used as a gelling agent. The gel compositions may be used to suspend various solids and/or liquids.</p>			

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GEL COMPOSITIONS

CROSS-REFERENCE TO RELATED APPLICATIONS

2 This patent application claims priority to a previously filed U.S. provisional application
3 Serial No. 60/106,094, filed October 29, 1998, entitled "Gel Composition," in the name of Lin
4 Lu, Jack Cunningham, Jr., and David S. Morrison. The disclosure of the aforementioned
5 provisional patent application is incorporated by reference in its entirety herein.

FIELD OF THE INVENTION

8 This invention relates to gel compositions which include esters, ethers, alcohols, naturally-
9 occurring fats and oils, or mixtures thereof.

BACKGROUND OF THE INVENTION

12 Numerous gel compositions are known in the art. Some have proven to be a convenient
13 and efficient vehicle or carrier for the application of various active ingredients to the skin. Such
14 active ingredients include antiperspirants, deodorants, perfumes, sunscreens, cosmetics,
15 emollients, insect repellants, medicaments, and the like. Products incorporating a gel composition
16 and those made entirely from a gel composition may be in the form of a soft gel or a stick.
17 Rubbing a soft gel or solid stick containing an effective amount of an active ingredient dissolved
18 or dispersed therein against the skin causes transfer of the gel composition to the skin surface in
19 a layer form, leaving the active ingredient within the layer on the desired skin surface.

1 For topical administration of various cosmetic and health and beauty materials to the skin,
2 a gel composition preferably should have one or more of the following desired properties:
3 transparency, compatibility with the active ingredient, controlled release of the active ingredient,
4 minimization of skin irritation, and the ability to suspend organic and inorganic materials, such as
5 color pigments, glitters, water, air, metal oxides, sunscreen active particulates, and fragrances.
6 In sunscreen applications, it is desirable if the gel itself could act as a sunscreen active ingredient.
7 Moreover, it should moisturize the skin and exhibit water wash-off resistance, but should not have
8 significant syneresis. For industrial applications, a gel base may offer one or more of the
9 following properties: suspension, moisture barrier, rheology, solvency, controlled release, wetting,
10 self-emulsifying, etc. For example, in the paint industry the properties that are important are
11 suspension and controlled release.

12 A gel composition typically is made by mixing one or more compounds to be gelled with
13 a gelling agent. Known gelling agents include metal soaps, surfactants, homopolymers, ionic
14 homopolymers and copolymers, fumed silica, natural derivatives of gums, waxes, clay, and so on.
15 Common gelling agents for cosmetic oils are fatty acid soaps of lithium, calcium, sodium,
16 aluminum, zinc, and barium. A number of homopolymers and copolymers, such as atactic
17 ethylene-propylene copolymers, have been used to gel hydrocarbons. For example, gelled mineral
18 oils have been available; however, gel compositions including an ester, ether, alcohol, or vegetable
19 oil are less common. Because gel compositions including an ester, alcohol, ether, or naturally-
20 occurring fat or oil may provide a better alternative to hydrocarbon gels, there is a need for
21 exploring methods of making such gel compositions.

SUMMARY OF THE INVENTION

2 The invention meets the aforementioned need in one or more of the following aspects.
3 In one aspect, the invention relates to a gel composition that includes an ester compound and a
4 polymer compound selected from the group consisting of triblock copolymers, star polymers,
5 radial polymers, multi-block copolymers, and combinations thereof. The gel composition
6 optionally may include a diblock copolymer. When the gel composition includes a diblock
7 copolymer, the gel composition preferably is substantially free of mineral oils. In some
8 embodiments, the gel composition may further include a suspended component. In other
9 embodiments, the gel composition may further include an active ingredient. The active ingredient
10 includes, but is not limited to, sun screens, antiperspirants, deodorants, perfumes, cosmetics,
11 emollients, insect repellants, pesticides, herbicides, fungicides, plasticizers, insecticides, and
12 medicaments.

13 In another aspect, the invention relates to a gel composition which includes at least two
14 components. The first component is a compound selected from the group consisting of alcohols,
15 ethers, naturally-occurring fats and oils, and combinations thereof. The second component is a
16 polymer compound selected from the group consisting of diblock copolymers, triblock
17 copolymers, star polymers, radial polymers, multi-block copolymers, and combinations thereof.
18 In some embodiments, suitable alcohols include, but are not limited to, octyl dodecanol and
19 isostearyl alcohol. In other embodiments, suitable ethers include, but are not limited to, dicarylyl
20 ether. In still other embodiments, suitable naturally-occurring fats and oils include, but are not
21 limited to, linseed oil, soybean oil, sunflower seed oil, corn oil, sesame oil, olive oil, castor oil,
22 coconut oil, palm oil, and peanut oil.

1 In yet another aspect, the invention relates to a gel composition which includes at least
2 two components. The first component is a compound selected from the group consisting of
3 esters, alcohols, ethers, naturally-occurring fats and oils, and combinations thereof. The second
4 component is a polymer compound selected from the group consisting of alkyl galactomannan,
5 polybutadiene, and combinations thereof.

6 In still another aspect, the invention relates to a method of making a gel composition. The
7 method includes (a) mixing an ester compound with a polymer compound selected from the group
8 consisting of triblock copolymers, star polymers, radial polymers, multi-block copolymers, and
9 combinations thereof; (b) heating the mixture; (c) agitating the mixture until the mixture becomes
10 homogeneous; and (d) cooling the mixture.

11 In still yet another aspect, the invention relates to a method of making a gel composition.
12 The method includes (a) mixing an alcohol, an ether, or a naturally-occurring fat or oil with a
13 polymer compound selected from the group consisting of diblock copolymers, triblock
14 copolymers, star copolymers, radial polymers, multi-block copolymers, and combinations thereof;
15 (b) heating the mixture; (c) agitating the mixture until the mixture becomes homogeneous; and
16 (d) cooling the mixture.

17 In another aspect, the invention relates to a method of making a gel composition. The
18 method includes (a) mixing an ester, an alcohol, an ether, or a naturally-occurring fat or oil with
19 alkyl galactomannan, or polybutadiene; (b) heating the mixture; (c) agitating the mixture until the
20 mixture becomes homogeneous; and (d) cooling the mixture.

21 Properties and advantages of the embodiments of the invention become apparent with the
22 following description.

1

BRIEF DESCRIPTION OF THE DRAWINGS

3 Fig. 1 is a schematic illustrating the chain structure of a diblock copolymer used in
4 embodiments of the invention.

5 Fig. 2 is a schematic illustrating the chain structure of a triblock copolymer used in
6 embodiments of the invention.

7 Fig. 3 is a schematic illustrating the chain structure of a radial polymer used in
8 embodiments of the invention.

9 Fig. 4 is a schematic illustrating the chain structure of a star polymer used in embodiments
10 of the invention.

11 Figs. 5A-5B are schematics illustrating the chain structure of multi-block copolymers used
12 in embodiments of the invention.

13

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

15 Embodiments of the invention are, in part, based on the discovery that esters, alcohols,
16 ethers, and naturally-occurring fats and oils can be gelled by using selected polymeric gelling
17 agents. For example, diblock copolymers, triblock copolymers, radial polymers, star polymers,
18 multi-block copolymers, butyl rubbers, alkyl galactomannan, and mixtures thereof can be used as
19 gelling agents to obtain gelled esters, gelled ethers, gelled alcohols, and gelled naturally-occurring
20 fats and oils. In some embodiments, the gel compositions and products made therefrom are
21 transparent or substantially transparent. In other embodiments, the gel compositions and products
22 made therefrom are semi-transparent, hazy, or opaque. These gel compositions and products

1 made therefrom each have numerous cosmetic and industrial applications.

2 A gel refers to a two-phase colloidal system comprising a liquid and a solid in the form
3 of thickened liquid, semi-solid or solid. A gel also can refer to a composition that is either
4 physically cross-linked by virtue of entangled polymer chains, or chemically cross-linked by
5 virtue of covalent bonds such that it swells, but does not dissolve, in the presence of liquid.

6 A gel typically is obtained by use of a gelling agent. The term "polymer" used herein includes
7 both homopolymer and copolymer. A homopolymer is a polymer obtained by polymerizing
8 one type of monomer, whereas a copolymer is a polymer obtained by polymerizing two or
9 more types of monomers. "Block copolymer" refers to a copolymer in which like monomer
10 units occur in relatively long, alternate sequences on a chain.

11 The term "opaque" refers to the optical state of a medium whose molecular aggregation
12 is such that light cannot pass through. Therefore, light transmission through an opaque medium
13 is substantially close to zero. On the other hand, the term "transparent" refers to the optical state
14 of a medium through which light can pass through so that an object can be seen through it. As
15 defined, the term "transparent" includes any optical state which is not opaque. A medium is
16 considered transparent even if only a small fraction of light passes through it. Thus, a clear gel
17 and a translucent gel are considered transparent.

18 In some embodiments of the invention, a block copolymer capable of forming a three-
19 dimensional network through physical cross-linking is used as the gelling agent. Suitable block
20 copolymers include at least one rigid block and one elastomeric block. The rigid blocks of a
21 block copolymer form rigid domains through which physical cross-linking may occur. The
22 physical cross-linking via these rigid domains yields a continuous three-dimensional network.

1 In the presence of heat, shear, or solvent, the rigid domains soften and permit flow. Upon
2 cooling, removal of shear, or solvent evaporation, the rigid domains reform and harden,
3 locking the elastomeric network in place. Preferably, suitable block copolymers include
4 diblock copolymers, triblock copolymers, radial polymers, star polymers, multi-block
5 copolymers, and mixtures thereof.

6 The amount of a gelling agent may range from about 0.2% to about 80% by weight,
7 depending on the desired properties of the resulting gel. Preferably, a gelling agent is present
8 in the gel from about 1% to about 40% by weight. More preferably, a gelling agent is present
9 in the gel about 5% to about 20% by weight. In embodiments where both a diblock copolymer
10 and a triblock copolymer are used, the triblock copolymer may range from about 0.1% to about
11 10%, and the diblock copolymer from about 1% to about 40%.

12 Fig. 1 illustrates the typical chain structure of a diblock copolymer. The polymer chain
13 of the diblock copolymer includes two blocks: a rigid block and an elastomeric block. The rigid
14 block is represented by diamonds. The elastomeric block is represented by circles. The rigid
15 block typically is composed of polystyrene, polyethylene, polyvinylchloride, phenolics, and the
16 like; the elastomeric block may be composed of, ethylene/butadiene copolymers, polyisoprene,
17 polybutadiene, ethylene/propylene copolymers, ethylene-propylene/diene copolymers, and the like.
18 As such, suitable diblock copolymers include, but are not limited to, styrene-ethylene/propylene
19 copolymers, styrene-ethylene/butadiene copolymers, styrene-isoprene copolymers, styrene-
20 butadiene copolymers.

21 Fig. 2 illustrates the chain structure of a triblock copolymer. As illustrated in Fig. 2, each
22 polymer chain includes two rigid blocks at either end and a middle block which is elastomeric.

1 This is a preferred triblock copolymer structure, although a triblock copolymer with two
2 elastomeric end blocks and a rigid middle block also can be used. Suitable triblock copolymers
3 include, but are not limited to, styrene-ethylene/propylene-styrene copolymers, styrene-
4 ethylene/butadiene-styrene copolymers, styrene-isoprene-styrene copolymers, and styrene-
5 butadiene-styrene copolymers. Multi-block copolymers are similar to diblock copolymers or
6 triblock copolymers, except that the multiple block copolymers include additional elastomeric
7 blocks and/or rigid blocks as illustrated in Figs. 5A-5B.

8 In addition to the linear chain structure, branched homopolymers or copolymers also may
9 be used. Figs. 3-4 illustrate the chain structure of a radial polymer and a star polymer. It should
10 be noted that one or more functional groups may be grafted onto the chain of any of the
11 aforementioned polymers. In other words, any of the above polymers may be modified by
12 grafting. Suitable functional groups for grafting depend on the desired properties. For example,
13 one or more ester groups, silane groups, silicon-containing groups, maleic anhydride groups,
14 acrylamide groups, and acid groups may be grafted. In addition to grafting, the above polymers
15 may be hydrogenated to reduce unsaturation before they are used as gelling agents.

16 Numerous commercially available block copolymers may be used in embodiments of the
17 invention. For example, various grades of copolymers sold under the trade name of Kraton[®] from
18 Shell Chemical Company can be used as a gelling agent. In addition, copolymers sold under the
19 trade name of Vector[®] available from Dexco and Septon[®] from Kuraray also may be used. U.S.
20 Patent Nos. 5,221,534, No. 5,578,089, and No. 5,879,694 disclose block copolymers which may
21 be used in embodiments of the invention, the disclosures of the three patents are incorporated by
22 reference in their entirety herein. Table 1 lists some commercially available block copolymers

1 which may be used in embodiments of the invention. It is noted that additional suitable block
 2 copolymers may include, but are not limited to, polystyrene/polyester, polyether/polyamide,
 3 polyether/polyester, polyester/polyamide, polyether/polyurethane, polyester/polyurethane,
 4 poly(ethylene oxide)/poly(propylene oxide), nylon/rubber, and polysiloxane/polycarbonate.

TABLE 1

Copolymer	Block Type	Polystyrene Content(%)	Comment
Kraton® G 1702	SEP	28	hydrogenated diblock
Kraton® G 1701	SEP	37	hydrogenated diblock
Kraton® G 1780	SEP	7	star polymer
Kraton® G 1650	SEBS	30	hydrogenated triblock
Kraton® G 1652	SEBS	30	hydrogenated triblock
Kraton® D 1101	SEBS+SEP	31	triblock and diblock mixture (85:15)
Kraton® D 1102	SEBS + SEP	28	triblock + diblock (85:15)
Kraton® D 1133	SEBS +SEP	35	triblock + diblock (66:34)
Kraton® FG 1901	SEBS	30	triblock (hydrogenated and functionally grafted with 1.7% of maleic anhydride)
Septon® 1001	SEP	35	Hydrogenated diblock
Vector® 6030	SEP	30	Unsaturated diblock
Vector® 8550	SBS	29	Unsaturated triblock
Vector® 2518P	SBS	31	Unsaturated triblock
Solprene® 1430	SB	40	Unsaturated diblock

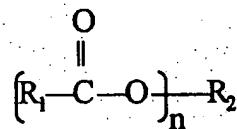
Note: SEP denotes to styrene/ethylene/propylene copolymers
 SEBS denotes to styrene/ethylene/butylene/styrene copolymers
 SB denotes to styrene/butadiene copolymers
 SBS denotes to styrene-butadiene-styrene copolymers

1 It should be noted that block copolymers are not the only gelling agents that can be
2 used in embodiments of the invention. Other types of polymers also may be used.
3 Homopolymers which are capable of effecting strong molecular interaction between polymeric
4 chains can be used as gelling agents. One such example is butyl rubber, which can thicken oil
5 due to its compatibility with oil and high molecular weight. Specifically, a polybutadiene
6 polymer sold under the trademark of Solprene® S200, which is available from GIRSA
7 Industrias Negromex, S.A.de C.V. (INSA), can be used as a gelling agent. Other
8 homopolymers capable of forming hydrogen bonding may include polyamide, polyester, and
9 polyolefin. Still another example is alkyl galactomannan, which is capable of forming strong
10 hydrogen bonding. Alkyl galactomannan is available from Hercules Incorporated under the
11 trade name of N-HANCE® AG50 and AG200. Alkyl galactomannan is a polymer obtained by
12 modifying natural products. It is especially effective in gelling esters and naturally-occurring
13 fats and oils.

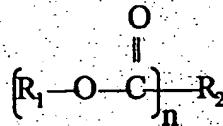
14 In accordance with embodiments of the invention, a gelled ester composition is
15 obtained by gelling an ester compound with a triblock copolymer, a star polymer, a radial
16 polymer, a multi-block copolymer, or mixtures thereof. Optionally, the gelled ester
17 composition may further include one or more diblock copolymers. When a diblock
18 copolymer is used along with one of triblock copolymers, star polymers, radial polymers, and
19 multi-block copolymers, the resulting gel composition is substantially free of mineral oils.
20 Suitable esters also may be gelled by alkyl galactomannan, polybutadiene, or other
21 aforementioned polymers.

22 Any ester compound may be used in embodiments of the invention to obtain a gelled

1 ester composition. An ester is defined as a compound that includes one or more carboxylate
2 groups: R—COO—, where R is hydrogen, hydrocarbyl, phenyl, methoxyphenyl, alkylphenyl,
3 substituted alkyl, substituted phenyl, or other organic radicals. Suitable esters include
4 monoesters, diesters, triesters, etc. For example, one class of suitable esters that can be gelled
5 is represented by the
6 following formulas:

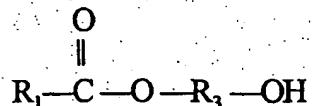


7
8 and
9



10
11 where n=1, 2, 3, and 4, and R₁ includes hydrogen, hydrocarbyl, phenyl, methoxyphenyl,
12 alkylphenyl, substituted alkyl, and substituted phenyl; and R₂ includes hydrogen, hydrocarbyl,
13 phenyl, methoxyphenyl, alkylphenyl, substituted alkyl, substituted phenyl, alkylene,
14 phenylene, substituted alkylene, substituted phenylene, etc. It is noted that a suitable group
15 for R₂ depends on whether n is 1, 2, 3, or 4.

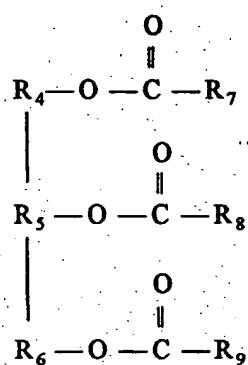
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17 Another class of suitable esters that may be gelled in embodiments of the invention is
18 represented by the following formula:



20
21
22

1 where R_3 includes alkylene, phenylene, substituted alkylene, and substituted phenylene.

2 Still another class of suitable esters that may be gelled in embodiments of the invention
 3 is represented by the following formula:



11 where R_4 , R_5 , and R_6 individually include alkylene, phenylene, substituted alkylene, and
 12 substituted phenylene; R_7 , R_8 , and R_9 individually include hydrogen, hydrocarbyl, phenyl,
 13 methoxyphenyl, alkylphenyl, substituted alkyl, and substituted phenyl.

14 Preferred esters and their chemical formulas are listed in Table 2.

15 TABLE 2

16 Chemical Name	17 Chemical Formula
17 Isononyl Isononanoate	$ \begin{array}{c} \text{O} \\ \\ \text{C}_8\text{H}_{17}-\text{C}-\text{O}-\text{C}_9\text{H}_{19} \end{array} $
18 Isopropyl Palmitate	$ \begin{array}{c} \text{O} \\ \\ \text{C}_{13}\text{H}_{27}-\text{C}-\text{O}-\text{C}_3\text{H}_7 \end{array} $

Chemical Name	Chemical Formula
1 C₁₂₋₁₅ alkyl benzoate	
2 Myristyl Neopentanoate	
3 Tridecyl Salicylate	
4 Octyl Methoxycinnamate	
5 Propylene glycol 6 dicaprylate/caprate	
7 Pentaerythrityl tetraisostearate	<p data-bbox="780 1727 1339 1759">(R represents fatty acid radicals derived from coconut oil.)</p>

	Chemical Name	Chemical Formula
1 2	Trimethylolpropane triisostearate	$ \begin{array}{c} \text{O} \\ \\ \text{CH}_2-\text{O}-\text{C}-\text{R} \\ \\ \text{CH}_2-\text{CH}_2-\text{C}-\text{CH}_2-\text{O}-\text{C}-\text{R} \\ \\ \text{O} \\ \\ \text{CH}_2-\text{O}-\text{C}-\text{R} \end{array} $ <p>(R represents fatty acid radicals derived from coconut oil.)</p>
3	Glyceryl isostearate	$ \begin{array}{c} \text{O} \\ \\ \text{C}_{17}\text{H}_{35}-\text{C}-\text{O}-\text{CH}_2-\text{CH}-\text{CH}_2\text{OH} \end{array} $
4	Diisonyl adipate	$ \begin{array}{c} \text{O} \quad \text{O} \\ \quad \\ \text{CH}_9-\text{O}-\text{C}-(\text{CH}_2)_4-\text{C}-\text{O}-\text{CH}_9 \end{array} $
5	Trioctyldodecyl citrate	$ \begin{array}{c} \text{O} \\ \\ \text{CH}_2-\text{C}-\text{O}-\text{R} \\ \\ \text{HO}-\text{C}-\text{C}-\text{O}-\text{R} \\ \\ \text{O} \\ \\ \text{CH}_2-\text{C}-\text{O}-\text{R} \end{array} $ <p>(R is octyl dodecyl)</p>

6

7

8 Other suitable esters include, but are not limited to, the following compounds:

9 Acefylline Methylsilanol Mannuronate; Acetaminosalol; Acetylated Cetyl Hydroxyproline;

10 Acetylated Glycol Stearate; Acetylated Sucrose Distearate; Acetylmethionyl Methylsilanol

1 Elastinate; Acetyl Tributyl Citrate; Acetyl Triethyl Citrate; Acetyl Trihexyl Citrate; Aleurites
2 Moluccana Ethyl Ester; Allethrins; Allyl Caproate; Amyl Acetate; Amyl Benzoate; Amyl
3 Salicylate; Arachidyl Behenate; Arachidyl Glycol Isostearate; Arachidyl Propionate; Ascorbyl
4 Dipalmitate; Ascorbyl Palmitate; Ascorbyl Stearate; Aspartame; Batyl Isostearate; Batyl
5 Stearate; Bean Palmitate; Behenyl Beeswax; Behenyl Behenate; Behenyl Benzoate; Behenyl
6 Erucate; Behenyl Isostearate; Behenyl/Isostearyl Beeswax; 1,2,4-Benzenetriacetate; Benzoin
7 (Styrax Bensoin) Gum; Benzoxiquine; Benzyl Acetate; Benzyl Benzoate; Benzyl Cinnamate;
8 Benzyl Hyaluronate; Benzyl Laurate; Benzyl Nicotinate; Benzylparaben; Benzyl Salicylate;
9 Beta-Sitosteryl Acetate; Borago Officinalis Ethyl Ester; Butoxyethyl Acetate; Butoxyethyl
10 Nicotinate; Butoxyethyl Stearate; Butyl Acetate; Butyl Acetyl Ricinoleate; Butyl Benzoate;
11 Butyl Benzyl Phthalate; 2-t-Butylcyclohexyl Acetate; Butylene Glycol Dicaprylate/Dicaprante;
12 Butylene Glycol Montanate; Butyl Ester of Ethylene/MA Copolymer; Butyl Ester of PVM/MA
13 Copolymer; Butylglucoside Caprate; Butyl Isostearate; Butyl Lactate; Butyl Methacrylate;
14 Butyl Myristate; Butyloctyl Beeswax; Butyloctyl Benzoate; Butyloctyl Candelillate; Butyloctyl
15 Oleate; Butyloctyl Salicylate; Butyl Oleate; Butyl PABA; Butylparaben; Butyl Phthalyl Butyl
16 Glycolate; Butyl Stearate; Butyl Thioglycolate; Butyroyl Trihexyl Citrate; C18-36 Acid Glycol
17 Ester; C12-20 Acid PEG-8 Ester; Caffeine Benzoate; Calcium Pantetheine Sulfonate; Calcium
18 Stearyl Lactylate; C-18-28 Alkyl Acetate; C18-38 Alkyl Beeswax; C30-50 Alkyl Beeswax;
19 C20-40 Alkyl Behenate; C18-38 Alkyl C24-54 Acid Ester; C-8 Alkyl Ethyl Phosphate; C18-38
20 Alkyl Hydroxystearoyl Stearate; C12-13 Alkyl Lactate; C12-15 Alkyl Lactate; C12-13 Alkyl
21 Octanoate; C12-15 Alkyl Octanoate; C12-15 Alkyl Salicylate; C18-36 Alkyl Stearate; C20-40
22 Alkyl Stearate; C30-50 Alkyl Stearate; C40-60 Alkyl Stearate; Caproyl Ethyl Glucoside;

1 Capryloyl Salicylic Acid; Caprylyl Butyrate; Castor Oil Benzoate; C10-30
2 Cholesterol/Lanosterol Esters; Cellulose Acetate; Cellulose Acetate Butyrate; Cellulose Acetate
3 Propionate; Cellulose Acetate Propionate Carboxylate; Ceteareth-7 Stearate; Cetearyl
4 Behenate; Cetearyl Candelillate; Cetearyl Isononanoate; Cetearyl Octanoate; Cetearyl
5 Palmitate; Cetearyl Stearate; Cetyl Acetate; Cetyl Acetyl Ricinoleate; Cetyl Caprylate; Cetyl
6 C12-15-Pareth-9 Carboxylate; Cetyl Glycol Isostearate; Cetyl Isononanoate; Cetyl Lactate;
7 Cetyl Laurate; Cetyl Myristate; Cetyl Octanoate; Cetyl Oleate; Cetyl Palmitate; Cetyl PCA;
8 Cetyl PPG-2 Isodeceth-7 Carboxylate; Cetyl Ricinoleate; Cetyl Ricinoleate Benzoate; Cetyl
9 Stearate; C16-20 Glycol Isostearate; C20-30 Glycol Isostearate; C14-16 Glycol Palmitate;
10 Chimyl Isostearate; Chimyl Stearate; Chlorogenic Acids; Cholesteryl Acetate;
11 Cholesteryl/Behenyl/Octyldodecyl Lauroyl Glutamate; Cholesteryl Butyrate; Cholesteryl
12 Dichlorobenzoate; Cholesteryl Hydroxystearate; Cholesteryl Isostearate; Cholesteryl Isostearyl
13 Carbonate; Cholesteryl Lanolate; Cholesteryl Macadamiate; Cholesteryl Nonanoate;
14 Cholesteryl/Octyldodecyl Lauroyl Glutamate; Cholesteryl Oleate; Cholesteryl Stearate;
15 Cinnamyl Acetate; Cinoxate; Citronellyl Acetate; Coco-Caprylate/Caprate; Coco Rapeseedate;
16 Cocoyl Ethyl Glucoside; Copper PCA Methylsilanol; Corylus Avellana Ethyl Ester; C12-15
17 Pareth-9 Hydrogenated Tallowate; C11-15 Pareth-3 Oleate; C12-15 Pareth-12 Oleate; C11-15
18 Pareth-3 Stearate; C11-15 Pareth-12 Stearate; Decyl Isostearate; Decyl Myristate; Decyl
19 Oleate; Decyl Succinate; DEDM Hydantoin Dilaurate; Dextrin Behenate; Dextrin Laurate;
20 Dextrin Myristate; Dextrin Palmitate; Dextrin Stearate; Diacetin; Dibutyl Adipate; Dibutyl
21 Oxalate; Dibutyl Phthalate; Dibutyl Sebacate; Di-C12-15 Alkyl Adipate; Di-C12-15 Alkyl
22 Fumarate; Di-C12-13 Alkyl Malate; Di-C12-13 Alkyl Tartrate; Di-C14-15 Alkyl Tartrate;

1 Dicapryl Adipate; Dicaprylyl Maleate; Dicetearyl Dimer Dilinoleate; Dicetyl Adipate; Dicetyl
2 Thiodipropionate; Dicocoyl Pentaerythrityl Distearyl Citrate; Diethoxyethyl Succinate; Diethyl
3 Acetyl Aspartate; Diethylaminoethyl Cocoate; Diethylaminoethyl PEG-5 Cocoate;
4 Diethylaminoethyl PEG-5 Laurate; Diethylaminoethyl Stearate; Diethyl Aspartate; Diethylene
5 Glycol Dibenzoate; Diethylene Glycol Diisononanoate; Diethylene Glycol Dioctanoate;
6 Diethylene Glycol Dioctanoate/Diisononanoate; Diethyl Glutamate; Diethyl Oxalate; Diethyl
7 Palmitoyl Aspartate; Diethyl Phthalate; Diethyl Sebacate; Diethyl Succinate; Digallyl
8 Trioleate; Diglyceryl Stearate Malate; Dihexyl Adipate; Dihexyldecyl Lauroyl Glutamate;
9 Dihydroabietyl Behenate; Dihydroabietyl Methacrylate; Dihydrocholesteryl Butyrate;
10 Dihydrocholesteryl Isostearate; Dihydrocholesteryl Macadamiate; Dihydrocholesteryl
11 Nonanoate; Dihydrocholesteryl Octyldecanoate; Dihydrocholesteryl Oleate; Dihydrogenated
12 Palmoyl Hydroxyethylmonium Methosulfate; Dihydrogenated Tallow Phthalate;
13 Dihydrophytosteryl Octyldecanoate; Dihydroxyethylamino Hydroxypropyl Oleate;
14 Dihydroxyethyl Soyamine Dioleate; Diisobutyl Adipate; Diisobutyl Oxalate; Diisocetyl
15 Adipate; Diisodecyl Adipate; Diisopropyl Adipate; Diisopropyl Dimer Dilinoleate;
16 Diisopropyl Methyl Cinnamate; Diisopropyl Oxalate; Diisopropyl Sebacate;
17 Diisostearamidopropyl Epoxypropylmonium Chloride; Diisostearoyl Trimethylolpropane
18 Siloxy Silicate; Diisostearyl Adipate; Diisostearyl Dimer Dilinoleate; Diisostearyl Fumarate;
19 Diisostearyl Glutarate; Diisostearyl Malte; Dilaureth-7 Citrate; Dilauryl Thiodipropionate;
20 Dimethicone Copolyol Acetate; Dimethicone Copolyol Adipate; Dimethicone Copolyol
21 Almondate; Dimethicone Copolyol Beeswax; Dimethicone Copolyol Behenate; Dimethicone
22 Copolyol Benzoate; Dimethicone Copolyol Borageate; Dimethicone Copolyol Cocoa Butterate;

- 1 Dimethicone Copolyol Dhupa Butterate; Dimethicone Copolyol Hydroxystearate; Dimethicone
- 2 Copolyol Isostearate; Dimethicone Copolyol Kokum Butterate; Dimethicone Copolyol Lactate;
- 3 Dimethicone Copolyol Laurate; Dimethicone Copolyol Mango Butterate; Dimethicone
- 4 Copolyol Meadowfoamate; Dimethicone Copolyol Mohwa Butterate; Dimethicone Copolyol
- 5 Octyldodecyl Citrate; Dimethicone Copolyol Olivate; Dimethicone Copolyol Phthalate;
- 6 Dimethicone Copolyol Sal Butterate; Dimethicone Copolyol Shea Butterate; Dimethicone
- 7 Copolyol Stearate; Dimethicone Copoly Undecylenate; Dimethiconol Beeswax; Dimethiconol
- 8 Behenate; Dimethiconol Borageate; Dimethiconol Dhupa Butterate; Dimethiconol
- 9 Fluoroalcohol Dillnoleic Acid; Dimethiconol Hydroxystearate; Dimethiconol Illipe Butterate;
- 10 Dimethiconol Isostearate; Dimethiconol Kokum Butterate; Dimethiconol Lactate; Dimethiconol
- 11 Mohwa Butterate; Dimethiconol Sal Butterate; Dimethiconol Stearate; Dimethyl Adipate;
- 12 Dimethylaminoethyl Methacrylate; Dimethyl Brassylate; Dimethyl Cystinate; Dimethyl
- 13 Glutarate; Dimethyl Maleate; Dimethyl Oxalate; Dimethyl Phthalate; Dimethyl Succinate;
- 14 Dimyristyl Tartrate; Dimyristyl Thiodipropionate; Dinonoxytol-9 Citrate; Dioctyl Adipate;
- 15 Dioctyl Butamido Triazone; Dioctyl Dimer Dilinoleate; Dioctyldodeceth-2 Lauroyl Glutamate;
- 16 Dioctyldodecyl Adipate; Dioctyldodecyl Dimer Dilinoleate; Dioctyldodecyl Dodecanedioate;
- 17 Dioctyldodecyl Fluoroheptyl Citrate; Dioctyldodecyl Lauroyl Glutamate; Dioctyldodecyl
- 18 Stearoyl Dimer Dilinoleate; Dioctyldodecyl Stearoyl Glutamate; Dioctyl Fumarate; Dioctyl
- 19 Malate; Dioctyl Maleate; Dioctyl Phthalate; Dioctyl Sebacate; Dioctyl Succinate; Dioleoyl
- 20 Edetolmonium Methosulfate; Dipalmitoyl Hydroxyproline; Dipentaerythrityl
- 21 Hexacaprylate/Hexacaprate; Dipentaerythrityl Hexaheptanoate/Hexacaprylate/Hexacaprate;
- 22 Dipentaerythrityl Hexahydroxystearate; Dipentaerythrityl

1 Hexahydroxystearate/Stearate/Rosinate; Dipentaerythrityl Hexaoctanoate/Behenate;
2 Dipentaerythrityl Pentahydroxystearate/Isostearate; Diphenyl Carbomethoxy Acetoxy
3 Naphthopyran; Dipropyl Adipate; Dipropylene Glycol Caprylate; Dipropylene Glycol
4 Dibenzoate; Dipropylene Glycol Salicylate; Dipropyl Oxalate; Disodium Laureth-7 Citrate;
5 Disodium PEG-5 Laurylcitrate Sulfosuccinate; Disodium PEG-8 Ricinosuccinate; Disodium
6 Succinoyl Glycyrrhetinate; Disodium 2-Sulfolaurate; Disteareth-2 Lauroyl Glutamate;
7 Disteareth-5 Lauroyl Glutamate; Distearyl Thiodipropionate; Ditallowoylethyl
8 Hydroxyethylmonium Methosulfate; Ditridecyl Adipate; Ditridecyl Dimer Dilinoleate;
9 Ditridecyl Thiodipropionate; Dodecyl Gallate; Erucyl Arachidate; Erucyl Erucate; Erucyl
10 Oleate; Ethiodized Oil; Ethoxydiglycol Acetate; Ethoxyethanol Acetate; Ethyl Acetate; Ethyl
11 Almondate; Ethyl Apricot Kernelate; Ethyl Arachidonate; Ethyl Aspartate; Ethyl Avocadate;
12 Ethyl Benzoate; Ethyl Biotinate; Ethyl Butylacetylaminopropionate; Ethyl Cinnamate; Ethyl
13 Cyanoacrylate; Ethyl Cyclohexyl Propionate; Ethyl Digydroxypropyl PABA; Dethyl
14 Diisopropylcinnamate; Ethylene Brassylate; Ethylene Carbonate; Ethyl Ester of Hydrolyzed
15 Animal Protein; Ethyl Ester of Hydrolyzed Keratin; Ethyl Ester of Hydrolyzed Silk; Ethyl
16 Ester of PVM/MA Copolymer; Ethyl Ferulate; Ethyl Glutamate; Ethyl Isostearate; Ethyl
17 Lactate; Ethyl Laurate; Ethyl Linoleate; Ethyl Linolenate; Ethyl Methacrylate; Ethyl
18 Methoxycinnamate; Ethyl Methylphenylglycidate; Ethyl Minkate; Ethyl Morrhuate; Ethyl
19 Myristate; Ethyl Nicotinate; Ethyl Oleate; Ethyl Olivate; Ethyl PABA Ethyl Palmitate;
20 Ethylparaben; Ethyl PCA; Ethyl Pelargonate; Ethyl Persate; Ethyl Phenylacetate; Ethyl
21 Ricinoleate; Ethyl Serinate; Ethyl Stearate; Ethyl Thioglycolate; Ethyl Urocanate; Ethyl Wheat
22 Germate; Ethyl Ximenynate; Etocrylene; Farnesyl Acetate; Galactonolactone; Galbanum

1 (Ferula Galbaniflua) Oil; Gamma-Nonalacione; Geranyl Acetate; Glucarolactone; Glucose
2 Glutamate; Glucose Pentaacetate; Glucuronolactone; Glycereth-7 Benzoate; Glycereth-7
3 Diisononanoate; Glycereth-8 Hydroxystearate; Glycereth-5 Lactate; Glycereth-25 PCA
4 Isostearate; Glycereth-7 Triacetate; Glyceryl Triacetyl Hydroxystearate; Glyceryl Triacetyl
5 Ricinoleate; Glycolamide Stearate; Glycol/Butylene Glycol Montanate; Glycol Catearate;
6 Glycol Dibehenate; Glycol Dilaurate; Glycol Dioctanoate; Glycol Dioleate; Glycol Distearate;
7 Glycol Ditallowate; Glycol Hydroxystearate; Glycol Montanate; Glycol Octanoate; Glycol
8 Oleate; Glycol Palmitate; Glycol Ricinoleate; Glycol Salicylate; Glycol Stearate; Glycol
9 Stearate SE; Glycyrrhetinyl Stearate; Hexacosyl Glycol Isostearate; Hexanediol Beeswax;
10 Hexanediol Distearate; Hexanetriol Beeswax; Hexyldecyl Benzoate; Hexyldecyl Ester of
11 Hydrolyzed Collagen; Hexyldecyl Isostearate; Hexyldecyl Laurate; Hexyldecyl Octanoate;
12 Hexyldecyl Oleate; Hexyldecyl Palmitate; Hexyldecyl Stearate; Hexylidodecyl Salicylate;
13 Hexyl Isostearate; Hexyl Laurate; Hexyl Nicotinate; Homosalate; Hydrogenated Castor Oil
14 Hydroxystearate; Hydrogenated Castor Oil Isostearate; Hydrogenated Castor Oil Laurate;
15 Hydrogenated Castor Oil Stearate; Hydrogenated Castor Oil Triisostearate; Hydrogenated
16 Methyl Abietate; Hydrogenated Rosin; Hydroquinone PCA; Hydroxycetyl Isostearate;
17 Hydroxyoctacosanyl Hydroxystearate; Inositol Hexa-PCA; Iodopropynyl Butylcarbamate;
18 Isoamyl Acetate; Isoamyl Laurate; Isoamyl p-Methoxycinnamate; Isobutyl Acetate;
19 Isobutylated Lanolin Oil; Isobutyl Benzoate; Isobutyl Myristate; Isobutyl Palmitate;
20 Isobutylparaben; Isobutyl Pelargonate; Isobutyl Stearate; Isobutyl Tallowate; Isoceteareth-8
21 Stearate; Isoceteth-10 Stearate; Isocetyl Behenate; Isocetyl Isodecanoate; Isocetyl Isostearate;
22 Isocetyl Laurate; Isocetyl Linoleoyl Stearate; Isocetyl Myristate; Isocetyl Octanoate; Isocetyl

1 Palmitate; Isocetyl Salicylate; Isocetyl Stearate; Isocetyl Stearyl Stearate; Isodeceth-2
2 Cocoate; Isodecyl Citrate; Isodecyl Cocoate; Isodecyl Hydroxystearate; Isodecyl Isononanoate;
3 Isodecyl Laurate; Isodecyl Myristate; Isodecyl Neopentanoate; Isodecyl Octanoate; Isodecyl
4 Oleate; Isodecyl Palmitate; Isodecylparaben; Isodecyl Salicylate; Isodecyl Stearate; Isohexyl
5 Laurate; Isohexyl Neopentanoate; Isohexyl Palmitate; Isolauryl Behenate; Isomerized Jojoba
6 Oil; Isononyl Ferulate; Isooctyl Thioglycolate; Isopropyl Acetate; Isopropyl Arachidate;
7 Isopropyl Avocadate; Isopropyl Behenate; Isopropyl Benzoate; Isopropylbenzyl Salicylate;
8 Isopropyl Citrate; Isopropyl C12-15-Pareth-9 Carboxylate; Isopropyl Hydroxystearate;
9 Isopropyl Isostearate; Isopropyl Jojobate; Isopropyl Lanolate; Isopropyl Laurate; Isopropyl
10 Linoleate; Isopropyl Myristate; Isopropyl Oleate; Isopropylparaben; Isopropyl PPG-2-
11 Isodeceth-7 Carboxylate; Isopropyl Ricinoleate; Isopropyl Sorbate; Isopropyl Stearate;
12 Isopropyl Tallowate; Isopropyl Thioglycolate; Isosorbide Laurate; Isosteareth-10 Stearate;
13 Isostearyl Avocadate; Isostearyl Behenate; Isostearyl Benzoate; Isostearyl Erucate; Isostearyl
14 Isononanoate; Isostearyl Isostearate; Isostearyl Isostearoyl Stearate; Isostearyl Lactate;
15 Isostearyl Laurate; Isostearyl Myristate; Isostearyl Neopentanoate; Isostearyl Octanoate;
16 Isostearyl Palmitate; Isostearyl Stearyl Stearate; Isotridecyl Isononanoate; Isotridecyl Laurate;
17 Isotridecyl Myristate; Jojoba (Buxus Chinensis) Oil; Jojoba Esters; Kojic Dipalmitate; Laneth-
18 9 Acetate; Laneth-10 Acetate; Laneth-4 Phosphate; Lanolin Linoleate; Lanolin Ricinoleate;
19 Laureth-2 Acetate; Laureth-2 Benzoate; Laureth-6 Citrate; Laureth-7 Citrate; Laureth-2
20 Octanoate; Laureth-7 Tartrate; Lauroyl Ethyl Glucoside; Lauroyl Lactyllic Acid; Lauryl
21 Behenate; Lauryl Cocoate; Lauryl Isostearate; Lauryl Lactate; Lauryl Methacrylate; Lauryl
22 Myristate; Lauryl Octanoate; Lauryl Oleate; Lauryl Palmitate; Lauryl Stearate; Linalyl

- 1 Acetate; Linoleyl Lactate; Madecassicoside; Mannitan Laurate; Mannitan Oleate; Menthyl
- 2 Acetate; Menthyl Anthranilate; Menthyl Lactate; Menthyl PCA; Menthyl Salicylate;
- 3 Methoxyisopropyl Acetate; Methoxy-PEG-7 Rutinyl Succinate; Methyl Acetate; Methyl Acetyl
- 4 Ricinoleate; Methyl Anthranilate; Methyl Behenate; Methyl Benzoate; Methyl Caproate;
- 5 Methyl Caprylate; Methyl Caprylate/Caprate; Methyl Cocoate; 6-Methyl Coumarin; Methyl
- 6 Dehydroabietate; Methyl Dihydroabietate; Methyldihydrojasmonate; Methyl Gluceth-20
- 7 Benzoate; Methyl Glucose Dioleate; Methyl Glucose Isostearate; Methyl Glucose Laurate;
- 8 Methyl Glucose Sesquicaprylate/Sesquicaprate; Methyl Glucose Sesquicocoate; Methyl
- 9 Glucose Sesquiisostearate; Methyl Glucose Sesquilaurate; Methyl Glucose Sesquioleate;
- 10 Methyl Glucose Sesquistearate; Methyl Glycrrhizate; Methyl Hydrogenated Rosinate; Methyl
- 11 Hydroxystearate; Methyl Isostearate; Methyl Laurate; Methyl Linoleate; Methyl 3-
- 12 Methylresorcylate; Methyl Myristate; Methyl Nicotinate; Methyl Oleate; Methyl Palmate;
- 13 Methyl Palmitate; Methylparaben; Methyl Pelargonate; Methyl Ricinoleate; Methyl Rosinate;
- 14 Methyl Salicylate; Methylsilanol Acetylmethionate; Methylsilanol Carboxymethyl
- 15 Theophylline; Methylsilanol Carboxymethyl Theophylline Alginate; Methylsilanol
- 16 Hydroxyproline; Methylsilanol Hydroxyproline Aspartate; Methylsilanol Mannuronate;
- 17 Methylsilanol PCA; Methyl Soyate; Methyl Stearate; Methyl Thioglycolate; Monosaccharide
- 18 Lactate Condensata; Myreth-3 Caprate; Myreth-3 Laurate; Myreth-2 Myristate; Myreth-3
- 19 Myristate; Myreth-3 Octanoate; Myreth-3 Palmitate; Myristoyl Ethyl Glucoside; Myristoyl
- 20 Lactylic Acid; Myristyl Isostearate; Myristyl Lactate; Myristyl Lignocerate; Myristyl
- 21 Myristate; Myristyl Octanoate; Myristyl Propionate; Myristyl Salicylate; Myristyl Stearate;
- 22 Neopentyl Glycol Dicaprate; Neopentyl Glycol Dicaprylate/Dicaprate; Neopentyl Glycol

1 Dicaprylate/Dipelargonate/Dicaprate; Neopentyl Glycol Diheptanoate; Neopentyl Glycol
2 Diisostearate; Neopentyl Glycol Dilaurate; Neopentyl Glycol Dioctanoate; Nonyl Acetate;
3 Nonyl Acetate; Octacosanyl Glycol Isostearate; Octocrylene; Octyl Acetoxystearate; Octyl
4 Benzoate; Octyl Caprylate/Caprate; Octyl Cocoate; Octyldecyl Oleate; Octyldodecyl Behenate;
5 Octyldodecyl Benzoate; Octyldodecyl Erucate; Octyldodecyl Hydroxystearate; Octyldodecyl
6 Isostearate; Octyldodecyl Lactate; Octyldodecyl Lanolate; Octyldodecyl Meadowfoamate;
7 Octyldodecyl Myristate; Octyldodecyl Neodecanoate; Octyldodecyl Neopentanoate;
8 Octyldodecyl Octanoate; Octyldodecyl Octyldodecanoate; Octyldodecyl Oleate; Octyldodecyl
9 Olivate; Octyldodecyl Ricinoleate; Octyldodecyl Stearate; Octyldodecyl Steroyl Stearate; Octyl
10 Gallate; Octyl Hydroxystearate; Octyl Hydroxystearate Benzoate; Octyl Isononanoate; Octyl
11 Isopalmitate; Octyl Isostearate; Octyl Laurate; Octyl Linoleyl Stearate; Octyl
12 Methoxycinnamate; Octyl Myristate; Octyl Neopentanoate; Octyl Octanoate; Octyl Oleate;
13 Octyl Palmitate; Octyl PCA; Octyl Pelagonate; Octyl Salicylate; Octyl Stearate; Oleoyl Ethyl
14 Glucoside; Oleth-2 Benzoate; Oleyl Acetate; Oleyl Arachidate; Oleyl Erucate; Oleyl Ethyl
15 Phosphate; Oleyl Lactate; Oleyl Lanolate; Oleyl Linoleate; Oleyl Myristate; Oleyl Oleate;
16 Oleyl Phosphate; Oleyl Stearate; Oryzanol; Ozonized Jojoba Oil; Palmitoyl Carnilene;
17 Palmitoyl Inulin; Palmitoyl Myristyl Serinate; Pantethine; Panthenyl Ethyl Ester Acetate;
18 Panthenyl Triacetate; PCA Glyceryl Oleate; Pea Palmitate; PEG-18 Castor Oil Dioleate; PEG-
19 5 DEDM Hydantoin Oleate; PEG-15 DEDM Hydantoin Stearate; PEG-30
20 Dipolyhydroxystearate; PEG-20 Hydrogenated Castor Oil Isostearate; PEG-50 Hydrogenated
21 Castor Oil Isostearate; PEG-20 Hydrogenated Castor Oil Triisostearate; PEG-20 Mannitan
22 Laurate; PEG-20 Methyl Glucose Distearate; PEG-80 Methyl Glucose Laurate; PEG-20

- 1 Methyl Glucose Sesquicaprylate/Sesquicaprate; PEG-20 Methyl Glucose Sesquilaureate; PEG-5
- 2 Oleamide Dioleate; PEG-150 Pentaerythrityl Tetraoleate; PEG-3/PPG-2 Glyceryl/Sorbitol
- 3 Hydroxystearate/Isostearate; PEG-4 Proline Linoleate; PEG-4 Proline Linolenate; PEG-8
- 4 Propylene Glycol Cocoate; PEG-55 Propylene Glycol Oleate; PEG-25 Propylene Glycol
- 5 Stearate; PEG-75 Propylene Glycol Stearate; PEG-120 Propylene Glycol Stearate; PEG-40
- 6 Sorbitol Hexaoleate; PEG-50 Sorbitol Hexaoleate; PEG-30 Sorbitol Tetraoleate Laurate; PEG-
- 7 60 Sorbitol Tetrastearate; PEG-5 Tricapryl Citrate; PEG-5 Tricetyl Citrate; PEG-5 Trilauryl
- 8 Citrate; PEG-5 Trimethylolpropane Trimyristate; PEG-5 Trimyristyl Citrate; PEG-5 Tristearyl
- 9 Citrate; PEG-6 Undecylenate; Pentadecalacione; Pentaerythrityl Dioleate; Pentaerythrityl
- 10 Distearate; Pentaerythrityl Hydrogenated Rosinate; Pentaerythrityl
- 11 Isostearate/Caprate/Caprylate/Adipate; Pentaerythrityl Rosinate; Pentaerythrityl Stearate;
- 12 Pentaerythrityl Stearate/Caprate/Caprylate/Adipate; Pentaerythrityl Stearate/Isostearate/Adipate/
- 13 Hydroxystearate; Pentaerythrityl Tetraabietate; Pentaerythrityl Tetraacetate; Pentaerythrityl
- 14 Tetra behenate; Pentaerythrityl Tetrabenzzoate; Petaerythrityl Tetracaprylate/Tetracaprate;
- 15 Pentaerythrityl Tetracocoate; Pentaerythrityl Tetraisononanoate; Pentaerythrityl Tetralaurate;
- 16 Pentaerythrityl Tetramyristate; Pentaerythrityl Tetraoctanoate; Pentaerythrityl Tetraoleate;
- 17 Pentaerythrityl Tetrapelargonate; Petaerythrityl Tetrastearate; Pentaerythrityl Trioleate;
- 18 Phenethyl Acetate; Phenolphthalein; Phenoxyethylparaben; Phenyl Benzoate; Phenylparaben;
- 19 Phenyl Salicylate; Phylosteryl Macadamiate; Poloxamer 105 Benzoate; Poloxamer 182
- 20 Dibenoate; Polycaprolactone; Polydimethylaminoethyl Methacrylate; Polyethylacrylate;
- 21 Polyethylglutamate; Polyethylmethacrylate; Polymethyl Acrylate; Polymethylglutamate;
- 22 Polysorbate 80 Acetate; Polyvinyl Acetate; Potassium Butylparaben; Potassium Deceth-4

1 Phosphate; Potassium Ethylparaben; Potassium Methylparaben; Potassium Propylparaben; PPG-
2 Isoocteeth-20 Acetate; PPG-14 Laureth-60 Alkyl Dicarbamate; PPG-20 Methyl Glucose Ether
3 Acetate; PPG-20 Methyl Glucose Ether Distearate; PPG-2 Myristyl Ether Propionate; PPG-14
4 Palmeth-60 Alkyl Dicarbamate; PPG-15 Steryl Ether Benzoate; Pregnenolone Acetate; Propyl
5 Acetate; Propyl Benzoate; Propylene Carbonate; Propylene Glicol Alginat; Propylene Glycol
6 Behenate; Propylene Glycol Caprylate; Propylene Glycol Ceteth-3 Acetate; Propylene Glycol
7 Ceteth-3 Propionate; Propylene Glycol Citrate; Propylene Glycol Cocoate; Propylene Glycol
8 Dicaprate; Propylene Glycol Dicaproate; Propylene Glycol Dicaprylate; Propylene Glycol
9 Dicocoate; Propylene Glycol Diisoononanoate; Propylene Glycol Diisostearate; Propylene
10 Glycol Dilaurate; Propylene Glycol Dioctanoate; Propylene Glycol Dioleate; Propylene Glycol
11 Dipelargonate; Propylene Glycol Distearate; Propylene Glycol Diundecanoate; Propylene
12 Glycol Hydroxystearate; Propylene Glycol Isoceteth-3 Acetate; Propylene Glycol Isostearate;
13 Propylene Glycol Laurate; Propylene Glycol Linoleate; Propylene Glycol Linolenate;
14 Propylene Glycol Myristate; Propylene Glycol Myristyl Ether Acetate; Propylene Glycol
15 Oleate; Propylene Glycol Oleate SE; Propylene Glycol Ricinoleate; Propylene Glycol Soyate;
16 Propylene Glycol Stearate; Propylene Glycol Stearate SE; Propyl Gallate; Propylparaben;
17 Pyricarbate; Pyridoxine Dicaprylate; Pyridoxine Dilaurate; Pyridoxine Dioctenoate;
18 Pyridoxine Dipalmitate; Pyridoxine Glycrrhetinate; Pyridoxine Tripalmitate; Raffinose
19 Myristate; Raffinose Oleate; Resorcinol Acetate; Retinyl Acetate; Retinyl Linoleate; Retinyl
20 Palmitate; Retinyl Propionate; Riboflavin Tetraacetate; Ribonolactone; Rosin Acrylate;
21 Siloxanetriol Phytate; Silybum Marianum Ethyl Ester; Sodium Behenyl Lactylate; Sodium
22 Butylparaben; Sodium Caproyl Lactylate; Sodium Cocoyl Lactylate; Sodium Dilaureth-7

1 Citrate; Sodium Ethylparaben; Sodium Ethyl 2-Sulfolaurate; Sodium Isostearoyl Lactylate;
2 Sodium Laureth-7 Tartrate; Sodium Lauroyl Lectylate; Sodium Methylparaben; Sodium
3 Methyl 2-Sulfolaurate; Sodium Oleoyl Lactylate; Sodium Panteheine Sulfonate; Sodium
4 Phytate; Sodium Propylparaben; Sodium Stearyl Lactylate; Sorbeth-2 Cocoate; Sorbeth-6
5 Hexastearate; Sorbeth-3 Isostearate; Sorbityl Acetate; Soybean Palmitate; Soy Sterol Acetate;
6 Stearamide DEA-Distearate; Stearamide DIBA-Stearate; Stearamide MEA-Stearate; Steareth-5
7 Stearate; Stearyl Lactylic Acid; Stearyl Acetate; Stearyl Acetyl Glutamate; Stearyl Beeswax;
8 Stearyl Behenate; Stearyl Benzoate; Stearyl Caprylate; Stearyl Citrate; Stearyl Erucate; Stearyl
9 Glycol Isostearate; Stearyl Glycyrrhetinate; Stearyl Heptanoate; Stearyl Lactate; Stearyl
10 Linoleate; Stearyl Octanoate; Stearyl Stearate; Stearyl Stearyl Stearate; Sucrose Acetate
11 Isobutyrate; Sucrose Benzoate; Sucrose Cocoate; Sucrose Dilaurate; Sucrose Distearate;
12 Sucrose Laurate; Sucrose Myristate; Sucrose Octaacetate; Sucrose Oleate; Sucrose Palmitate;
13 Sucrose Polybehenate; Sucrose Polycottonseedate; Sucrose Polylaurate; Sucrose Polylinoleate;
14 Sucrose Polypalmate; Sucrose Polysoyate; Sucrose Polystearate; Sucrose Ricinoleate; Sucrose
15 Stearate; Sucrose Tetrastearate Triacetate; Sucrose Tribehenate; Sucrose Tristearate; Tallowoyl
16 Ethyl Glucoside; Tannic Acid; TEA-Lauroyl Lactylate; Telmesteine; Terpineol Acetate;
17 Tetrabutyl Phenyl Hydroxybenzoate; Tetradecyleicosyl Stearate; Tetrahexyldecyl Ascorbate;
18 Tetrahydrofurfuryl Acetate; Tetrahydrofurfuryl Ricinoleate; Tocophersolan; Tocopheryl
19 Acetate; Tocopheryl Linoleate; Tocopheryl Linoleate/Oleate; Tocopheryl Nicotinate;
20 Tocopheryl Succinate; Tributyl Citrate; Tri-C12-13 Alkyl Citrate; Tri-C14-15 Alkyl Citrate;
21 Tricaprylyl Citrate; Tridecyl Behenate; Tridecyl Cocoate; Tridecyl Erucate; Tridecyl
22 Isononanoate; Tridecyl Laurate; Tridecyl Myristate; Tridecyl Neopentanoate; Tridecyl

1 Octanoate; Tridecyl Stearate; Tridecyl Stearyl Stearate; Tridecyl Trimellitate; Triethyl
2 Citrate; Triethylene Glycol hydrogenated Rosinate; Trihexyldecyl Citrate; Triisocetyl Citrate;
3 Triisopropyl Citrate; Triisopropyl Trilinoleate; Triisostearyl Citrate; Triisostearyl Trilinoleate;
4 Trilactin; Trilauryl Citrate; Trimethylolpropane Tricaprylate/Tricaprate; Trimethylolpropane
5 Tricocoate; Trimethylolpropane Trilaurate; Trimethylalpropane Trioctanoate;
6 Trimethylolpropane Tristearate; Trimethyl Pentanyl Diisobutyrate; Trioctyl Citrate;
7 Trioctyldodecyl Borate; Tricetyl Trimellitate; Trioleyl Citrate; TriPABA Panthenol;
8 Tripropylene Glycol Citrate; Tristearyl Citrate; Tristearyl Phosphate; Vinyl Acetate; and Yeast
9 Palmitate.

10 In addition to esters, alcohols may be gelled to form a gelled alcohol by using a diblock
11 copolymer, a triblock copolymer, a star polymer, a radial polymer, a multi-block copolymer,
12 and mixtures thereof. Suitable alcohols also may be gelled by alkyl galactomannan,
13 polybutadiene, or other aforementioned polymers. Any alcohols as represented by the
14 following formula may be gelled in embodiments of the invention.

15

R—OH

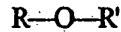
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17 where R represents any organic functional group which includes, but is not limited to,
18 hydrocarbyl, phenyl, methoxyphenyl, and alkylphenyl, substituted alkyl, substituted phenyl,
19 etc. Preferred alcohols include, but are not limited to, isostearyl alcohol, and octyl dodecanol.
20 Other suitable alcohols include, but are not limited to, Abietyl Alcohol; Arachidyl Alcohol;
21 Batyl Alcohol; Behenyl Alcohol; Benzyl Alcohol; Bishydroxyethyl Biscetyl Malonamide;
22 Borneol; 2-t-Butylcyclohexyloxybutanol; Butyloctanol; C9-11 Alcohol; C12-13 Alcohol; C12-

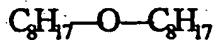
1 15 Alcohol; C12-16 Alcohol; C14-15 Alcohol; C-20-40 Alcohols; C30-50 Alcohols; C40-60
2 Alcohols; C18-38 Alkyl Hydroxystearoyl Stearate; Camphylcyclohexanol; Caproyl
3 Sphingosine; Caprylic Alcohol; Caprylyl Glycol; CD Alcohol 19; Ceramide 1; Ceramide 2;
4 Ceramide 3; Ceramide 4; Ceramide 5; Ceramide 1A; Ceramide 6 II; Cetearyl Alcohol; Cetyl
5 Alcohol; Cetyl arachidol; Cetyl Glycol; C9-13 Fluoroalcohol; C14-18 Glycol; C15-18 Glycol;
6 C18-30 Glycol; C20-30 Glycol; Chimyl Alcohol; Chlorphenesin; Cholecalciferol; Cholesterol;
7 Cinnamyl Alcohol; Citronellol; Coconut Alcohol; Decyl Alcohol; Decyltetradecanol; 7-
8 Dehydrocholesterol; Dichlorobenzyl Alcohol; Dihydrocholesterol; Dihydrolanosterol;
9 Dihydroxyacetone; Dihydroxyethylamino Hydroxypropyl Oleate; 2,6-Dimethyl-7-Octen-2-ol;
10 Dimethyl Octynediol; Dimethyl Phenylpropanol; Dodecylhexadecanol; Dodecyltetradecanol;
11 Ergocalciferol; Ethyl Hexanediol; Farnesol; Galactonolactone; Geraniol; Glycyrrhetic Acid;
12 Glycyrrhizic Acid; Heptylundecanol; Hexacosyl Glycol; 3-Hexenol; Hexyl Alcohol;
13 Hexyldecanol; Hexyldecyloctadecanol; Hexylene Glycol; Hinokitiol; Hydroabietyl Alcohol;
14 Hydrogenated Ethylbicycloneplane Guaiacol; Hydrogenated Tallow Alcohol; Hydrolyzed
15 Glycyrrhizinate; Hydroxycapric Acid; Hydroxycaproyl Phytosphingosine; Hydroxycaprylic
16 Acid; Hydroxycapryloyl Phytosphingosine; Hydroxyethyl Palmityl Oxyhydroxypropyl
17 Palmitamide; Hydroxylauric Acid; Hydroxylauroyl Phytosphingosine; Hydroxymethyl
18 Dioxoazabicyclooctane; Hydroxyproline; Hydroxystearyl Cetyl Ether; Jojoba Alcohol; Lactoyl
19 Phytosphingosine; Lanolin Alcohol; Lauryl Alcohol; Lauryl Glycol; Linalool; p-Menthane-7-ol;
20 Menthol; Menthone Glycerin Acetal; 3-Methylamino-4-Nitrophenoxyethanol; Methyl
21 Glycyrrhiziate; Methylsilanol Hydroxyproline; Myricyl Alcohol; Myristyl Alcohol; Nicotinyl
22 Alcohol; Nicotinyl Tartrate; 3-Nitro-4-Aminophenoxyethanol; Octacosanyl Glycol;

1 Octoxyglycerin; Octoxyglyceryl Behenate; Octyldodecanol; 2-Oeamido-1,3-Octadecanediol;
2 Oleyl Alcohol; Palm Alcohol; Palm Kernel Alcohol; Palmitamidohexadecanediol; Panthenol;
3 Panthenyl Ethyl Ether; Panthenyl Hydroxypropyl Steardimonium Chloride; Pentadecyl
4 Alcohol; Pentylene Glycol; Phenethyl Alcohol; Phenoxyethanol; Phenoxyisopropanol;
5 Phenylisohexanol; Phenylpropanol; Phytosphingosine; Polyvinyl Alcohol; Propanediol; Propyl
6 Alcohol; Propylene Glycol; Pyridoxine Glycyrrhetinate; Retinol; Ribonolactone; N-Stearoyl-
7 Dihydroshingosine; Stearyl Alcohol; Stearyl Glycol; Tallow Alcohol; Terpineol;
8 Tetradecyleicosanol; Tetradecyloctadecanol; Tetrahydrofurfuryl Alcohol; Tetramethyl
9 Cyclopentene Butenol; Tetramethyl Decynediol; Tridecyl Alcohol; Trimethylhexanol;
10 Troxerutin; Undeceth-3; Undecylenyl Alcohol; and Undecylpentadecanol.

11 Numerous ethers also may be gelled to form gelled ether compositions by using a
12 diblock copolymer, triblock copolymer, star polymer, radial polymer, multi-block copolymer,
13 or mixtures thereof. Suitable ethers also may be gelled by alkyl galactomannan,
14 polybutadiene, or other aforementioned polymers. Generally, an ether compound is
15 represented by the following formula:



18
19 where R and R' individually include, but are not limited to, hydrocarbyl, phenyl,
20 methoxyphenyl, alkylphenyl, substituted alkyl, substituted phenyl, etc. Preferred ethers
21 include, but are not limited to, dicaryl ether and octyl methoxycinnamate. Dicaryl ether
22 is represented by the following chemical formula.



Other suitable ethers include, but are not limited to, Anethole; p-Anisic Acid; Batyl Alcohol; Batyl Isostearate; Batyl Stearate; Benzylhemiformal; 1,3-Bis-(2,4-Diaminophenoxy) propane; Butoxyethyl Acetate; Butoxyethyl Nicotinate; Butoxyethyl Stearate; Butoxypropanol; 2-t-Butylcyclohexyloxybutanol; Butyl Glucoside; Butylglucoside Caprate; Butyl Methoxydibenzoylmethane; Caprylyl/Capryl Glucoside; Capsaicin; Carboxymethyl Chitin; Carboxymethyl Chitosan Succinamide; Carboxymethyl Dextran; Cetearyl Glucoside; Cetyl Glyceryl Ether; Cetyl-PG Hydroxyethyl Decanamide; Cetyl-PG Hydroxyethyl Palmitamide; Chimyl Alcohol; Chimyl Isostearate; Chimyl Stearate; Chlorphenesin; Cinoxate; Cocamidopropyl Lauryl Ether; Coceth-4 Glucoside; Coco-Glucoside; Dibenzylidene Sorbitol; Dicetyl Ether; Dichlorophenyl Imidazolidoxolan; Dimethicone Copolyol Butyl Ether; Dimethicone Copolyol Ethyl Ether; Dimethicone Copolyol Methyl Ether; Dimethyl Hexahydronaphthyl Dihydroxymethyl Acetal; Dimethyl Isosorbide; Dioleyl Tocopheryl Methylsilanol; Diosmine; Disodium Cetyl Phenyl Ether Disulfonate; Disodium Decyl Phenyl Ether Disulfonate; Disodium Lauryl Phenyl Ether Disulfonate; Distarch Glyceryl Ether; Distearyl Ether; Ethoxydiglycol Acetate; Ethoxyheptyl Bicyclooctanone; 7-Ethylbicyclooxazolidine; Ethyl Methoxycinnamate; Ethyl Methylphenylglycidate; Ethyl Phenethyl Acetal; Eucalyptol; Eugenol; Ferulic Acid; Glyceryl Octanoate; Dimethoxycinnamate; Glycofurool; Hexamethylindanopyran; Hexamidine; Hexamidine Diparaben; Hexamidine Paraben; Hydrogenated Ethylbicycloheptane Guaiacol; p-

- 1 Hydroxyanisole; Hydroxydecyl Maltitol; Hydroxyethyl Glyceryl Oleate/Stearate;
- 2 Hydroxyethyl Palmityl Oxyhydroxypropyl Palmitamide; Hydroxyethyl Sorbitol;
- 3 Hydroxymethoxybenzyl Pelargonamide; Hydroxypropyl Starch Phosphate; Hydroxystearyl
- 4 Cetyl Ether; Isobutyl Methyl Tetrahydropyranol; Isoeugenol; Isolongifolene Epoxide;
- 5 Isopropyl Hydroxycetyl Ether; Isostearamidopropyl Epoxypropyl Dimonium Chloride;
- 6 Isostearyl Glyceryl Ether; Isostearyl Glyceryl Pentaerythrityl Ether; Lauryl Polyglyceryl-6
- 7 Cetearyl Glycol Ether; Melatonin; Menthone Glycerin Acetal; MethoxyIndane;
- 8 Methoxyisopropyl Acetate; Methoxymethylbutanol; Methoxypropylgluconamide; Methylal;
- 9 Ethyl Eugenol; Methyl Hexyl Ether; Methylsilanol Ascorbate; Myristyl-PG Hydroxyethyl
- 10 Decanamide; 4-Nitroguaiacol; Octoxyglycerin; Octoxyglyceryl Behenate; Octoxyglyceryl
- 11 Palmitate; Octyl Glyceryl Palmitate; Oleyl Glyceryl Ether; Panthenyl Ethyl Ether; Panthenyl
- 12 Ethyl Ether Acetate; Panthenyl Hydroxypropyl Steardimonium Chloride; PEG-3 2,2-Di-p-
- 13 Phenylediamine; PEG-4 Ditalow Ether; PEG-150 Pentaerythrityl Tetrasteарате; p-
- 14 Phenetidine; Phenoxyzyethanol; Phenoxyethylparaben; Phenoxyisopropanol; Polyglycerin-3;
- 15 Polyglycerin-4; Polyglycerin-6; Polyglycerin-10; Polyglyceryl-3 Cetyl Ether; Polyglyceryl-3
- 16 Decyltetradecyl Ether; Polyglyceryl-3 Hydroxylauryl Ether; Polyglyceryl-2 Lanolin Alcohol
- 17 Ether; Polyglyceryl-4 Lauryl Ether; Polyglyceryl-2 Oleyl Ether; Polyglyceryl-4 Oleyl Ether;
- 18 Polyglyceryl Sorbitol; Polyvinyl Methyl Ether; Polyvinyl Stearyl Ether; PPG-9 Diglyceryl
- 19 Ether; PPG-1-PEG-9 Lauryl Glycol Ether; Propylene Glycol Myristyl Ether; Quassin;
- 20 Silanetriol Trehalose Ether; TEA-Lauryl Ether; Tetrahydrodiferuloylmethane; Thiodiglycol;
- 21 Triclosan; Triethylene Glycol; Trihydroxypalmitamidoxypropyl Myristyl Ether;
- 22 Trimethoxycaprylylsilane; Troxerutin; and Ubiquinone.

1 Embodiments of the invention may also be used to obtain gelled natural products, such
2 as naturally-occurring fats and oils. "Naturally-occurring fats and oils" often refer to the
3 glyceryl esters of fatty acids (i.e., triglycerides) normally found in animal or plant tissues,
4 including those which have been hydrogenated to reduce or eliminate unsaturation. Naturally
5 occurring fats and oils include vegetable oils. Selected naturally-occurring fats and oils are
6 represented by the following formula:

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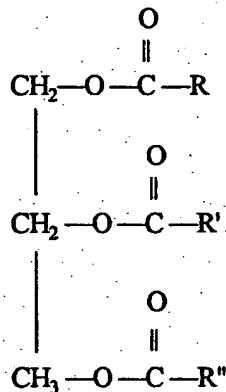
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15

16



where R, R' and R" may be the same or different fatty acid radicals.

17 Suitable naturally-occurring fats and oils that may be gelled by using a diblock
18 copolymer, triblock copolymer, star polymer, radial polymer, multi-block copolymer or
19 mixtures thereof. Suitable naturally-occurring fats and oils also may be gelled by alkyl
20 galactomannan, polybutadiene, or other aforementioned polymers. Examples of the suitable
21 naturally-occurring fats and oils include, but are not limited to, Adansonia Digitata Oil;
22 Apricot (*Prunus Armeniaca*) Kernel Oil; *Argania Spinosa* Oil; *Argemone Mexicana* Oil;

1 Avocado (*Persea Gratissima*) Oil; Babassu (*Orbignya Oleifera*) Oil; Balm Mint (*Melissa*
2 *Officinalis*) Seed Oil; Bitter Almond (*Prunus Amygdalus Amara*) Oil; Bitter Cherry (*Prunus*
3 *Cerasus*) Oil; Black Currant (*Ribes Nigrum*) Oil; Borage (*Borago Officinalis*) Seed Oil; Brazil
4 (Bertholletia Excelsa) Nut Oil; Burdock (*Arctium Lappa*) Seed Oil; Butter; C12-18 Acid
5 Triglyceride; *Calophyllum Tacamahaca* Oil; *Camellia Kissi* Oil; *Camellia Oleifera* Seed Oil;
6 Canola Oil; Caprylic/Capric/Lauric Triglyceride; Caprylic/Capric/Linoleic Triglyceride;
7 Caprylic/Capric/Myristic/Stearic Triglyceride; Caprylic/Capric/Stearic Triglyceride;
8 Caprylic/Capric Triglyceride; Caraway (*Carum Carvi*) Seed Oil; Carrot (*Daucus Carota*
9 *Sativa*) Oil; Cashew (*Anacardium Occidentale*) Nut Oil; Castor Oil Benzoate; Castor (*Ricinus*
10 *Communis*) Oil; Cephalins; Chaulmoogra (*Taraktogenos Kurzii*) Oil; Chia (*Salvia Hispanica*)
11 Oil; Cocoa (*Theobroma Cacao*) Butter; Coconut (*Cocos Nucifera*) Oil; Cod Liver Oil; Coffee
12 (*Coffea Arabica*) Oil; Corn (*Zea Mays*) Germ Oil; Corn (*Zea Mays*) Oil; Cottonseed
13 (*Gossypium*) Oil; C10-18 Triglycerides; Cucumber (*Cucumis Sativus*) Oil; Dog Rose (*Rosa*
14 *Canina*) Hips Oil; Egg Oil; Emu Oil; Epoxidized Soybean Oil; Evening Primrose (*Oenothera*
15 *Biennis*) Oil; Fish Liver Oil; Gevuina Avellana Oil; Glyceryl Triacetyl Hydroxystearate;
16 Glyceryl Triacetyl Ricinoleate; Glycolipids; Glycosphingolipids; Goat Butter; Grape (*Vitis*
17 *Vinifera*) Seed Oil; Hazel (*Corylus Americana*) Nut Oil; Hazel (*Corylus Aveilana*) Nut Oil;
18 Human Placental Lipids; Hybrid Safflower (*Carthamus Tinctorius*) Oil; Hybrid Sunflower
19 (*Helianthus Annuus*) Seed Oil; Hydrogenated Canola Oil; Hydrogenated Castor Oil;
20 Hydrogenated Castor Oil Laurate; Hydrogenated Castor Oil Triisostearate; Hydrogenated
21 Coconut Oil; Hydrogenated Cottonseed Oil; Hydrogenated C12-18 Triglycerides;
22 Hydrogenated Fish Oil; Hydrogenated Lard; Hydrogenated Menhaden Oil; Hydrogenated Milk

1. Lipids; Hydrogenated Mink Oil; Hydrogenated Olive Oil; Hydrogenated Orange Roughy Oil;
2. Hydrogenated Palm Kernel Oil; Hydrogenated Palm Oil; Hydrogenated Peanut Oil;
3. Hydrogenated Rapeseed Oil; Hydrogenated Shark Liver Oil; Hydrogenated Soybean Oil;
4. Hydrogenated Tallow; Hydrogenated Vegetable Oil; *Isatis Tinctoria* Oil; *Job's Tears (Coix Lacryma-Jobi)* Oil; *Kiwi (Actinidia Chinensis)* Seed Oil; *Kukui (Aleurites Moluccana)* Nut Oil; Lard; Lauric/Palmitic/Oleic Triglyceride; Linseed (*Linum Usitatissimum*) Oil; Lupin (*Lupinus Albus*) Oil; *Macadamia Ternifolia* Nut Oil; Maleated Soybean Oil; *Mango (Mangifera Indica)* Seed Oil; Marmot Oil; Meadowfoam (*Limnanthes Alba*) Seed Oil;
5. Menhaden Oil; Milk Lipids; Mink Oil; *Moringa Pterygosperma* Oil; *Mortierella* Oil; Musk Rose (*Rosa Moschata*) Seed Oil; Neatsfoot Oil; Neem (*Melia Azadirachta*) Seed Oil; Oat (*Avena Sativa*) Kernel Oil; Oleic/Linoleic Triglyceride;
6. Oleic/Palmitic/Lauric/Myristic/Linoleic Triglyceride; Oleostearine; Olive (*Olea Europaea*) Husk Oil; Olive (*Olea Europaea*) Oil; Omental Lipdis; Orange Roughy Oil; Ostrich Oil;
7. Oxidized Corn Oil; Palm (*Elaeis Guineensis*) Kernel Oil; Palm (*Elaeis Guineensis*) Oil; Passionflower (*Passiflora Edulis*) Oil; Peach (*Prunus Persica*) Kernel Oil; Peanut (*Arachis Hypogaea*) Oil; Pecan (*Carya Illinoensis*) Oil; Pengawar Djambi (*Cibotium Barometz*) Oil; Phospholipids; Pistachio (*Pistacia Vera*) Nut Oil; Placental Lipids; Poppy (*Papaver Orientale*) Oil; Pumpkin (*Cucurbita Pepo*) Seed Oil; Quinoa (*Chenopodium Quinoa*) Oil; Rapeseed (*Brassica Campestris*) Oil; Rice (*Oryza Sativa*) Bran Oil; Rice (*Oryza Sativa*) Germ Oil;
8. Safflower (*Carthamus Tinctorius*) Oil; Salmon Oil; Sandalwood (*Santalum Album*) Seed Oil;
9. Seabuchthorn (*Hippophae Rhamnoides*) Oil; Sesame (*Sesamum Indicum*) Oil; Shark Liver Oil;
10. Shea Butter (*Butyrospermum Parkii*); Silk Worm Lipids; Skin Lipids; Soybean (*Glycine Soja*)

1 Oil; Soybean Lipid; Sphingolipids; Sunflower (*Helianthus Annuus*) Seed Oil; Sweet Almond
2 (Prunus *Amygdalus Dulcis*) Oil; Sweet Cherry (*Prunus Avium*) Pit Oil; Tali Oil; Tallow; Tea
3 Tree (*Melaleuca Alternifolia*) Oil; Telpharia Pedata Oil; Tomato (*Solanum Lycopersicum*)
4 Oil; Triarachidin; Tribehenin; Tricaprin; Tricaprylin; Trichodesma Zeylanicum Oil; Trierucin;
5 Triheptanoin; Triheptylundecanoin; Trihydroxymethoxystearin; Trihydroxystearin;
6 Triisononanoic; Triisopalmitin; Triisostearin; Trilaurin; Trilinolein; Trilinolenin; Trimyristin;
7 Trioctanoin; Triolein; Tripalmitin; Tripalmitolein; Triricinolein; Trisebacin; Tristearin;
8 Triundecanoin; Tuna Oil; Vegetable Oil; Walnut (*Juglans Regia*) Oil; Wheat Bran Lipids; and
9 Wheat (*Triticum Vulgare*) Germ Oil.

10 The gel compositions in accordance with embodiments of the invention may be
11 obtained by the following method. First, one or more compounds to be gelled are mixed with
12 a gelling agent. Second, the mixture typically is heated to a temperature in the range of about
13 70° C. to about 140° C, although other temperatures also are acceptable. The mixture is
14 agitated until a homogeneous mixture is obtained. The homogeneous mixture is then cooled
15 to room temperature. A gel composition is thus obtained. It is noted that the compound to
16 be gelled need not be mixed with a gelling agent before heating. Instead, the compound may
17 be heated to a desired temperature first, and then the gelling agent is added to the compound.

18

19 The following examples are given to illustrate embodiments of the invention. They are
20 merely exemplary and are not intended to limit the scope of the invention otherwise described
21 herein. All numerical values disclosed herein are approximate numbers. In some examples,
22 an antioxidant was added in an amount of about 0.02%. Any antioxidants can be used. One

1. suitable antioxidant is 2,6-di-tert-butyl-4-methylphenol ("BHT").

2

3

EXAMPLE 1

4. A sample of gelled isopropyl myristate (available under the trade name of Estol 1512,
5. Lexol IPM, etc.) was prepared (85.28 wt. % isopropyl myristate + 14.30 wt. % Kraton G
6. 1702 + 0.40 wt. % Kraton G 1650). The finished gel exhibited excellent clarity and had a
7. Brookfield viscosity (5 rpm, spindle T-C) of 157,000 CPS at 25° C.

8

9

EXAMPLE 2

10. A sample of gelled octyl methoxycinnamate (trade names: Parsol MCX, Escalol 557,
11. Neo Heliopan AV) was prepared (87.58 wt. % octyl methoxycinnamate + 12.00 wt. %
12. Kraton G 1701 + 0.40 wt. % Kraton G 1650). The finished gel was clear and stable through
13. several freeze/thaw cycles.

14

15

EXAMPLE 3

16. A sample of zinc oxide suspension in gelled octyl methoxycinnamate was prepared by
17. using 50.00 wt. % of zinc oxide and 50.00 wt. % of the gelled octyl methoxycinnamate
18. illustrated in Example 2. The finished suspension had good consistency and maintained
19. stability without separation for 15 days under thermal stress.

20

21

EXAMPLE 4

22. A sample of gelled propylene glycol dicaprylate/caprate (trade name: Estol 1526) was

1 prepared (87.58 wt. % propylene glycol dicaprylate/caprate + 12.00 wt. % Kraton G 1780
2 + 0.40 wt. % Kraton G 1650). The gel was clear at ambient temperature.

3

4

EXAMPLE 5

5 A sample of gelled isostearyl neopentanoate (trade name: Dermol 185) was prepared
6 (85.58 wt. % isostearyl neopentanoate + 14.00 wt. % Septon 1001 + 0.40 wt. % Kraton G
7 1650). The finished gel was clear and stable without syneresis.

8

9

EXAMPLE 6

10 Jojoba oil gel was prepared (91.28% jojoba oil + 0.4% Kraton G 1650 + 8.3% Kraton
11 G 1702). The gel was clear and viscous.

12

13

EXAMPLE 7

14 Eicosyl erucate (trade name: Erucical EG-20) gel was prepared (91.28% Erucical EG-
15 20 + 0.4% Kraton G 1650 + 8.3% Kraton G 1702). The gel was clear and stable without
16 syneresis.

17

18

19

20

In addition to the above examples of gel compositions, various other gel compositions
also were obtained. Tables 3-6 summarize the gel compositions obtained in accordance with
embodiments of the invention.

TABLE 3

INCI Name	Ester (wt.%)	Kraton® G1650	Kraton® G1702	Kraton® G1701	Kraton® G1780	Septon® 1001	Kraton® FG1901	Kraton® G1652
Isopropyl Myristate	85.28	0.4	14.3					
	90.58	0.4	9.00					
Isopropyl Palmitate	87.58	0.4	12.00					
	89.58	0.4	10.00					
	85.58	0.4	14.00					
C12-15 Alkyl Benzoate	83.58	0.4	16.00					
	87.58	0.4	12.00					
	87.98		12.00					
	89.58	0.4	10.00					
	89.98	10.00						
Octyl Methoxycinnamate	89.58	0.40	10.00					
	83.58	0.40	16.00					
	85.58	0.40	14.00					
	81.58	0.40	12.00					
	83.58	0.40		16.00				
	87.58	0.40		12.00				
	85.58	0.40		14.00				
	89.58	0.40		10.00				
Octyl Dodecyl Neopentanoate	81.98			12.00				
Isostearyl Neopentanoate	85.58	0.40				14.00		
	81.98			12.00				
Tridecyl Salicylate	87.58	0.40	12.00					
	91.28	0.4	8.30					
Octyl Dodecanol	89.58	0.4		10.00				
	88.89			6.67			4.44	
	90.00		5.48					4.5
	90.00		5.45					
	87.58	0.4	12.00					
	89.58	0.4	10.00					
Propylene Glycol Dicaprylate/caprate	87.58	0.4			12.00			
Jojoba Oil	91.28	0.4	8.30					

26

27

28

TABLE 4

	Polymer Type	Ester (%)	Polymer (%)	Antioxidant (%)
1,2-benzene-dicarboxylic acid, di-C ₈₋₁₀ br alkyl ester	Vector [®] 6030	91.98	8	0.02
	Vector [®] 8550	91.98	8	0.02
	Vector [®] 2518P	91.98	8	0.02
	Solprene [®] S200	91.98	8	0.02
1,2 benzene-dicarboxylic acid, di-undecyl ester	Vector [®] 6030	91.98	8	0.02

TABLE 5

	Oil Type	Polymer Type	Oil (%)	Polymer (%)	Antioxidant (%)
Sunflower Seed Oil		Kraton [®] D1102	91.9	8	0.10
		Kraton [®] D1133	91.9	8	0.10
		Kraton [®] D1101	91.9	8	0.10
		Vector [®] 6030	91.9	8	0.10
Corn Oil	Vector [®] 6030	91.9	8	0.10	
Sesame Oil	Vector [®] 6030	91.9	8	0.10	
Soybean Oil		Kraton [®] D1101	89.90	10	0.10
		Kraton [®] D1102	85.98	14	0.02
		Vector [®] 6030	91.90	8	0.10
Linseed Oil		Kraton [®] D1102	85.90	14	0.10
		Vector [®] 6030	91.90	8	0.10

1 TABLE 6

2 Oil Type	3 Oil (%)	4 Isopropyl 5 Palmitate 6 (%)	7 Alkyl 8 Galactomannan 9 (%)	10 Antioxidant 11 (%)
12 Sunflower 13 Seed 14 Oil	15 46.99	16 46.99	17 6.0	18 0.02
	19 44.99	20 44.99	21 10.0	22 0.02
	23 75.18	24 18.8	25 6.0	26 0.02
	27 71.95	28 18.0	29 10.0	30 0.05
31 Corn Oil	32 75.1	33 18.8	34 6.0	35 0.10
	36 71.9	37 18.0	38 10.0	39 0.10
40 Soybean Oil	41 75.1	42 18.8	43 6.0	44 0.10
	45 71.9	46 18.0	47 10.0	48 0.10
49 Sesame Oil	50 68.9	51 25.0	52 6.0	53 0.10
	54 65.31	55 25.5	56 9.1	57 0.09
58 Olive Oil	59 68.9	60 25.0	61 6.0	62 0.10
	63 65.9	64 25.0	65 9.0	66 0.10

12 EXAMPLE 8

13 An *in-vivo* test was conducted to evaluate the waterproof efficacy of a sunscreen lotion
14 based on a gelled ester composition. The *in-vivo* test procedure was conducted in accordance
15 with the FDA monographs for sunscreen testing published in *Federal Register*, Vol. 43, No. 166,
16 August 25, 1978. Briefly, a finished sunscreen lotion was applied to a skin surface which was
17 subsequently submerged in water. Before water immersion, the sun protection factor ("SPF")
18 was measured. After eighty minutes of water immersion, the SPF value was measured again. The
percentage of the remaining SPF is indicative of the waterproof efficacy of the sunscreen lotion.

19 In this example, two sunscreen lotions were prepared according to Table 7. Both lotions
20 contained approximately the same amount of a sunscreen active ingredient, i.e., octyl
21 methoxycinnamate ("OMC"). Sunscreen Lotion A included gelled OMC, whereas Sunscreen
22 Lotion B included neat OMC. Both sunscreen lotions contained approximately the same amounts
23 of other ingredients as indicated in Table 7.

TABLE 7

	Ingredient	Sunscreen Lotion A	Sunscreen Lotion B
3	De-ionized water	45.74	45.74
4	Tetra sodium EDTA	0.10	0.10
5	Propylene Glycol	2.50	2.50
6	Carbopol 940 (2% solution)	25.00	25.00
7	DEA-cetyl phosphate	1.00	1.00
8	Cetearyl Alcohol and Ceteareth 20	1.50	1.50
9	Mineral oil	—	1.26
10	Octyl Methoxycinnamate	—	7.50
11	Octyl Methoxycinnamate + Hydrogenated Ethylene/propylene/	8.76	—
12	styrene copolymers + Hydrogenated Butylene/ethylene/styrene		
13	copolymers		
14	Dimethicone	2.00	2.00
15	Diisodecyl Adipate	7.00	7.00
16	C ₁₂₋₁₅ Alkyl Benzoate	5.00	5.00
17	Triethanol amine	0.40	0.40
18	Diazolidinyl urea + propylene glycol + methylparaben +	1.00	1.00
19	propylparaben		
20	Remaining SPF after 80 min. water immersion	84%	69%

22 After eighty minutes of water immersion, the remaining SPF for Sunscreen Lotion A was
 23 about 84% of the pre-immersion SPF. As to Sunscreen Lotion B, the remaining SPF was about
 24 69% of its pre-immersion SPF. Therefore, the test result indicates that inclusion of a gelled
 25 sunscreen active ingredient increases the waterproof efficacy of the sunscreen lotion.

1 EXAMPLE 9

2 This example shows that gelled esters are comparable to petrolatum as an occlusive agent.
3 An *in-vivo* skin barrier test was utilized to evaluate a gelled ester's ability to enhance the barrier
4 function of the stratum corneum of human skin. Three different ester gels were formulated and
5 evaluated in this test. Their respective formulations are listed in Table 8.

6 TABLE 8
7

8 Sample	9 Intermediate	10 Ester 11 (wt.%)	12 Kraton 13 G1701 14 (wt.%)	15 Kraton 16 G1650 17 (wt.%)	18 Kraton 19 G1701 20 (wt.%)	21 Anti- 22 oxidant 23 (%)
9 Gel No. 1	10 C ₁₂₋₁₅ Alkyl 11 Benzzoate	12 85.58	13 14.00	14 0.40	15 —	16 0.02
10 Gel No. 2	11 Isopropyl Palmitate	12 87.58	13 12.00	14 0.40	15 —	16 0.02
11 Gel No. 3	12 Octyl 13 Methoxycinnamate	14 85.58	15 —	16 0.40	17 14.00	18 0.02

12 An independent laboratory conducted Trans-Epidermal Water Loss ("TEWL") testing
13 using the above gel compositions. Thirteen subjects were employed. TEWL measurements were
14 taken on each subject at baseline and at 1, 2, and 3 hours after the application of a test material.
15 A Servomed® Evaporimeter was used to measure the effectiveness of a topically applied test
16 material. The evaporimeter samples relative humidity at two points above the skin surface which
17 allowed the rate of water loss to be calculated from the measured humidity gradient. Petrolatum
18 also was included in the measurements. The data obtained from the TEWL measurements are
19 presented in Table 9.

1 TABLE 9

2 Test Material	Baseline	Hour 1		Hour 2		Hour 3	
		mean	Δ%	mean	Δ%	mean	Δ%
3 Gel No. 1	7.07	5.47	22.6%	5.44	23.1%	5.26	25.6%
4 Gel No. 2	6.66	5.37	19.4%	5.14	22.8%	4.72	29.1%
5 Gel No. 3	6.76	5.79	14.3%	5.49	18.8%	5.25	22.3%
6 Petrolatum	6.64	4.64	30.1%	4.28	35.5%	4.13	37.8%

7 Note: Δ% = (Baseline - Mean)*100/ Baseline.

8 The data indicate that all three gelled esters are effective in retaining moisture in the skin.
 9
 10 Consequently, gelled esters can be used as an occlusive agent in various health and beauty aid
 11 compositions.

12 EXAMPLE 10

13 This example shows that a gelled composition has significantly higher loading capacity as
 14 a suspension system. To compare the loading capacity of gelled soybean oil with that of neat
 15 soybean oil, two experiments were conducted: about 3 grams coated TiO₂ powder were
 16 suspended in about 97 grams of neat soybean oil; and about 50 grams of the same coated TiO₂
 17 powder were suspended in 50 grams of gelled soybean oil. No dispersant agent was used in either
 18 suspension system. The gelled soybean oil was made from the following formulation: about 85.9
 19 wt.% of commercially available soybean oil and about 14 wt.% of Kraton[®] D1102. It was
 20 observed that only about 2 wt.% of TiO₂ remained suspended in the neat soybean oil. In contrast,
 21 about 50 wt.% of TiO₂ was suspended in the gelled soybean oil. It is surprising that the loading
 22 capacity of gelled soybean oil is about 25 times more than that of neat soybean oil. The increased
 23 loading capacity by using a gelled naturally-occurring fat or oil should result in improved
 24 performance and cost savings.

1 Accordingly, the gel compositions in accordance with embodiments of the invention have
2 numerous cosmetic and industrial applications. The gel compositions may be used alone or in
3 combination with one or more additional ingredients. For example, the gel compositions are
4 suitable as lubricants, suspending agents, emulsion stabilizers, thickening agents, personal care
5 ingredients, air freshener components, pesticide and insecticide components, ingredients for candle
6 and ornamental products, pharmaceutical carriers and carrier ingredients, ointment base
7 ingredients, sporting goods, and vehicles for carrying other materials. Since esters are generally
8 considered as biodegradable materials, this allows gelled esters to find application in products
9 where minimal pollution is desired. Examples include fishing line lubricant, solder flux,
10 agricultural dust reduction and lubrication, textile coating, protective coating for transporting
11 fragile or environmentally-sensitive materials, and biodegradable oils and greases.

12 It has been discovered that the gel compositions in accordance with embodiments of the
13 invention keep solids and/or liquids substantially uniformly suspended and evenly dispersed over
14 a substantial period of time. The suspended liquids and/or solids may be present in the gel in
15 amounts of up to about 95 weight percent. Suitable solids and/or liquids that can be suspended
16 in the gel include any solid or non-hydrocarbon oil liquid which will disperse into the gel and
17 remain substantially suspended or evenly dispersed therein.

18 Examples of suitable solids include, but are not limited to, zinc oxide, coated zinc oxide,
19 surface-treated zinc oxide, titanium dioxide, coated titanium dioxide, surface-treated titanium
20 dioxide, phosphorescent substances, fluorescent materials, molybdenum oxide, zinc sulfide,
21 copper-doped zinc sulfide, graphite, explosive materials, pesticides, herbicides, fungicides,
22 insecticides, plasticizers; air sensitive chemicals, moisture sensitive chemicals, boron nitride, iron

1 oxides, talc, mica, plastics, polymers, silica, silicon dioxide, aluminum oxide, inorganic materials,
2 organometallic materials, metal particles, medical materials (such as antibacterials, antibiotics,
3 antimicrobials, antifungals, and anesthetics), glass, clays, gums, capsules containing an active
4 ingredient, starch, modified starch, other encapsulated materials, and mixtures thereof.

5 Examples of oil insoluble liquids which can be suspended in the gels include, but are not
6 limited to, water, water containing one or more water soluble materials, glycerin, propylene
7 glycol, butylene glycol, alcohols, acids, surfactants, emulsifiers, polyglycerols, ethers, polar esters,
8 fluorinated compounds, perfluoropolyethers, silicones, silicon-containing compounds, and the
9 mixtures thereof.

10 Pending U.S. Patent Application Serial No. 09/007,838, entitled "Hydrocarbon Gels as
11 Suspending and the Dispersing Agents and Products," filed January 15, 1998, discloses methods
12 of making a suspension system based on gelled hydrocarbons. The disclosed methods can be
13 utilized in embodiments of the invention to make suspension systems which are based on gelled
14 esters, gelled alcohols, gelled naturally-occurring fats and oils, or gelled ethers. The disclosure
15 of the above-referenced patent application is incorporated by reference in its entirety herein.

16 The gel compositions in accordance with embodiments of the invention also have a wide
17 spectrum of cosmetic applications when the gel compositions include an effective amount of one
18 or more cosmetic and health and beauty aid ingredients. By "effective amount," it is meant that
19 a sufficient amount of the ingredient is present to be effective for the indicated purpose in the
20 composition. An effective amount may range from about 0.001 to about 80 wt.%. By "cosmetic
21 and health and beauty aid ingredients," it is meant any material which can be applied topically to
22 the human skin or any part thereof for cleansing, beautifying, promoting attractiveness, and

1 protecting or altering the appearance of the skin without altering or interfering with the
2 physiological competence of the human skin or body. Included within this definition are creams,
3 lotions, emollients, fragrance oils, moisturizers, humectants, cosmetic oils, and so on. The gel
4 compositions in accordance with embodiments of the invention also may contain skin care
5 preservatives, diluents, surfactants, anti-wrinkle agents, and the like.

6 Furthermore, the gel compositions may be utilized to manufacture various over-the-
7 counter ("OTC") products. An OTC product may be made entirely from a gel composition; or
8 only a component of the OTC is made from the gel composition. Examples of OTC products
9 include, but are not limited to, antiperspirants, lip balms, and sunscreen (e.g., natural sunblocks,
10 such as submicron particles of metal oxides or synthetic sunblock agents, such as octyl
11 methoxycinnamate and benzophenone-3).

12 As mentioned above, the gel composition in accordance with embodiments of the
13 invention may be utilized as carrier vehicles for topical administration of various cosmetic and
14 health and beauty aid materials to the skin. Thus, such materials can be incorporated into the gel
15 which are applied to the skin to be absorbed, to form a film on the skin, to provide a cooling
16 sensation, to treat dry skin or oily skin, to work a material into the skin, to alter the overall texture
17 of the skin, or to change color. All of these effects are sought to be achieved by various health
18 and beauty aid products. Methods for making such skin care products are known in the art. For
19 example, U.S. Patent No. 5,558,872 discloses a clear gelled mineral oil based skin protectant.
20 Similar skin protectants may be made by substituting the mineral oil gel by the gel compositions
21 in accordance with embodiments of the invention. The disclosure of U.S. Patent No. 5,558,872
22 is incorporated by reference in its entirety herein.

1 It is noted that preferred uses of the gel compositions in accordance with embodiments
2 of the invention include formation of thickened liquids, soft gels and semi-solid gels. Gels are
3 particularly useful in waterproofing sunscreen compositions, makeup, mascara, etc. They also are
4 useful in petrolatum-based products, such as petroleum jelly, makeup foundation, and night
5 creams. They also can be used as substitutes for water-soluble polymers in products, such as lip
6 rouge-cream, eyeliner liquid, and the like. They also may be used as a gelling agent in facial oil.

7 Semi-solid or solid gels have applications as toiletry sticks, such as a stick insect repellent
8 or a matrix for clear or opaque stick products, which include deodorants, antiperspirants, lipsticks,
9 analgesics, blushers, solid lotions and solid absorbable flexible gels. Methods for making such
10 cosmetic sticks are known. For example, U.S. Patent No. 5,756,082 discloses a cosmetic stick
11 composition based on a hydrocarbon oil gel. The disclosed hydrocarbon oil gels may be
12 substituted by the gel compositions in accordance with embodiments of the invention to make
13 cosmetic stick compositions. The disclosure of U.S. Patent No. 5,756,082 is incorporated by
14 reference in its entirety herein.

15 As demonstrated above, the gel compositions in accordance with embodiments of the
16 invention have a wide range of industrial and cosmetic applications. When so used, the gel
17 compositions may exhibit one or more of the following properties or advantages: transparency;
18 compatibility with active ingredients; reduction or elimination of syneresis; ability to act as a
19 vehicle to provide a stable suspension of an ingredient; moisturization; enhancement of wash-off
20 resistance; provision of improved SPF when formulated into sunscreen products; reduction in
21 absorption and irritation; elimination or minimization of whitening effect; ability to act as a
22 cosmetic base; controlled release of volatile ingredients; and formulation with less emulsifiers.

1 Other properties and advantages are apparent to a person of ordinary skill in the art.

2 While the invention has been described with respect to a limited number of embodiments,
3 modifications and variations therefrom exist. For example, although suitable esters, ethers,
4 alcohols, and naturally-occurring fats and oils have been described with some depth, other
5 compounds also can be used. Additional suitable esters may include alkoxylated fatty acids,
6 glyceryl ethers, and sorbitan derivatives. Additional suitable alcohols may include alkanolamides,
7 alkanolamines, fatty alcohols, polyols, phenols, and sterols. Additional suitable ethers include
8 heterocyclic ethers, e.g., tocopherol, alkoxylated alcohols, alkoxylated amides, alkoxylated
9 amines, alkoxylated carboxylic acids, polymeric ethers, and glyceryl ethers. Similarly, naturally-
10 occurring fats and oils may include so-called "essential oils," which are volatile organic
11 constituents of plants normally obtained by distillation. In addition to the above-described
12 compounds, aldehydes and ketones also may be formed into gel compositions in accordance with
13 embodiments of the invention. The appended claims are intended to encompass all such
14 modifications and the variations as falling within the scope of the invention.

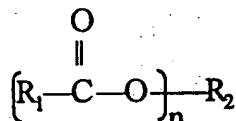
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16 What is claimed is:

1 1. A gel composition, comprising:
 2 an ester compound; and
 3 a polymer compound selected from the group consisting of triblock copolymers, star
 4 polymers, radial polymers, multi-block copolymers, and combinations thereof.

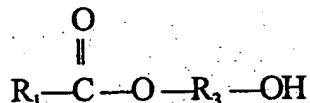
1 2. The gel composition of claim 1, further comprising a diblock copolymer,
 2 wherein the gel composition is substantially free of mineral oils.

1 3. The gel composition of claim 1, wherein the ester is represented by the following formulas:



10 wherein n=1, 2, 3, and 4, and R₁ includes hydrogen, hydrocarbyl, phenyl, methoxyphenyl,
 11 alkylphenyl, substituted alkyl, and substituted phenyl;
 12 R₂ includes hydrogen, hydrocarbyl, phenyl, methoxyphenyl, alkylphenyl, substituted alkyl,
 13 substituted phenyl, alkylene, phenylene, substituted alkylene, and substituted phenylene.

1 4. The gel composition of claim 1, wherein the ester is represented by the following formula:



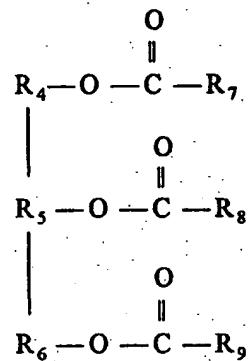
5 wherein R₁ includes hydrogen, hydrocarbyl, phenyl, methoxyphenyl, alkylphenyl,
 6 substituted alkyl, and substituted phenyl, and R₃ includes alkylene, phenylene, substituted alkylene,
 7 or substituted phenylene.

1 5. The gel composition of claim 1, wherein the ester is represented by the following formula:

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11 wherein R_4 , R_5 , and R_6 individually include alkylene, phenylene, substituted alkylene, or
12 substituted phenylene, and R_7 , R_8 and R_9 individually include hydrogen, hydrocarbyl, phenyl,
13 methoxyphenyl, alkylphenyl, substituted alkyl, and substituted phenyl.

1

2 6. The gel composition of claim 1, wherein the ester is selected from the group consisting
3 of isopropyl myristate, isopropyl palmitate, C_{12} - C_{18} alkyl benzoate, octyl methoxycinnamate, octyl
4 dodecyl neopentanoate, propylene glycol dicaprylate/caprate, jojoba oil, and isostearyl
neopentanoate.

1

2 7. The gel composition of claim 1, wherein the polymer compound is present in the amount
of about 1% to about 40 % by weight.

1

2 8. The gel composition of claim 2, wherein the diblock copolymer is selected from the group
3 consisting of styrene-ethylene/propylene copolymers, styrene-ethylene/butadiene copolymers,
styrene-isoprene copolymers, and styrene-butadiene copolymers.

1

2 9. The gel composition of claim 1, wherein the triblock copolymer is selected from the group
3 consisting of styrene-ethylene/propylene-styrene copolymers, styrene-ethylene/butadiene-styrene
copolymers, styrene-isoprene-styrene copolymers, and styrene-butadiene-styrene copolymers.

- 1 10. The gel composition of claim 2, wherein the diblock copolymer is hydrogenated.
- 1 11. The gel composition of claim 1, wherein the triblock copolymer is hydrogenated.
- 1 12. The gel composition of claim 1, wherein the triblock copolymer includes a grafted
2 functional group.
- 1 13. The gel composition of claim 1, further comprising a suspended component.
- 1 14. The gel composition of claim 13, further comprising a diblock copolymer.
- 1 15. The gel composition of claim 13, wherein the suspended component is a solid selected
2 from the group consisting of organic materials, inorganic materials, organometallic materials,
3 phosphorescent materials, and fluorescent materials.
- 1 16. The gel composition of claim 13, wherein the suspended component is a solid selected
2 from the group consisting of zinc oxide, coated zinc oxide, surface-treated zinc oxide, titanium
3 dioxide, surface-treated titanium dioxide, graphite, explosives, air-sensitive chemicals, moisture-
4 sensitive chemicals, boron nitride, iron oxides, talc, mica, plastics, polymers, silica, silicon dioxide,
5 aluminum oxide, metal particles, antibacterials, antibiotics, anesthetics, glass, clays, gums,
6 capsules containing an active ingredient, starch, modified starch, other encapsulated materials, and
7 combinations thereof.
- 1 17. The gel composition of claim 13, wherein the suspended component is a liquid selected
2 from the group consisting of water, water containing a water-soluble material, glycerin, propylene
3 glycol, butylene glycol, alcohols, acids, surfactants, emulsifiers, polyglycerols, ethers, polar esters,
4 fluorinated compounds, perfluoropolyethers, silicones, silicon-containing compounds, and
5 combinations thereof.
- 1 18. The gel composition of claim 1, further comprising an active ingredient.

1 19. The gel composition of claim 18, wherein the active ingredient is selected from the group
2 consisting of sunscreens, antiperspirants, deodorants, perfumes, cosmetics, emollients, insect
3 repellants, pesticides, herbicides, fungicides, plasticizers, insecticides, and medicaments.

1 20. A gel composition, comprising:
2 a compound selected from the group consisting of alcohols, ethers, naturally occurring fats
3 and oils, and combinations thereof; and
4 a polymer compound selected from the group consisting of diblock copolymers, triblock
5 copolymers, star polymers, radial polymers, multi-block copolymers, and combinations thereof.

1 21. The gel composition of claim 20, wherein the alcohols include octyl dodecanol or
2 isostearyl alcohol.

1 22. The gel composition of claim 20, wherein the ethers include dicarylyl ether.

1 23. The gel composition of claim 20, wherein the naturally occurring fats and oils include
2 linseed oil, soybean oil, sunflower seed oil, corn oil, sesame oil, olive oil, castor oil, coconut oil,
3 palm oil, and peanut oil.

1 24. A gel composition, comprising:
2 a compound selected from the group consisting of esters, alcohols, ethers, naturally
3 occurring fats and oils, and combinations thereof; and
4 a polymer compound selected from the group consisting of alkyl galactomannan,
5 polybutadiene, and combinations thereof.

- 1 25. A method of making a gel composition, comprising:
 - 2 mixing an ester compound with a polymer compound selected from the group consisting
 - 3 of triblock copolymers, star polymers, radial polymers, multi-block copolymers, and combinations
 - 4 thereof,
 - 5 heating the mixture;
 - 6 agitating the mixture until the mixture becomes homogeneous; and
 - 7 cooling the mixture.
- 1 26. A method of making a gel composition, comprising:
 - 2 mixing an alcohol, an ether or a naturally occurring fat or oil with a polymer compound
 - 3 selected from the group consisting of diblock copolymers, triblock copolymers, star polymers,
 - 4 radial polymers, multi-block copolymers, and combinations thereof,
 - 5 heating the mixture;
 - 6 agitating the mixture until the mixture becomes homogeneous; and
 - 7 cooling the mixture.
- 1 27. A method of making a gel composition, comprising:
 - 2 mixing an ester, an alcohol, an ether or a naturally occurring fat or oil with alkyl
 - 3 galactomannan or polybutadiene,
 - 4 heating the mixture;
 - 5 agitating the mixture until the mixture becomes homogeneous; and
 - 6 cooling the mixture.

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Diblock Copolymer

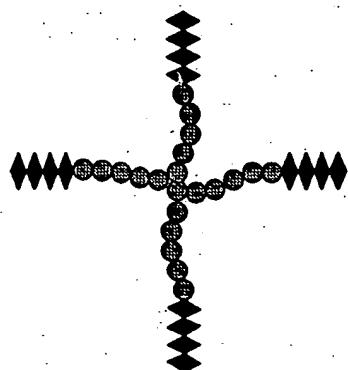
FIG. 1



Triblock Copolymer

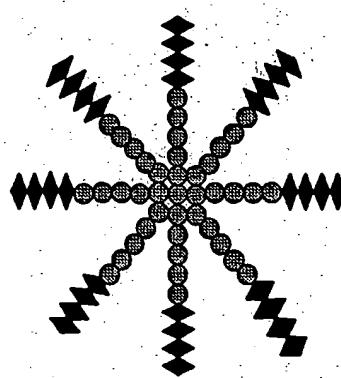
FIG. 2

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Radial Copolymer

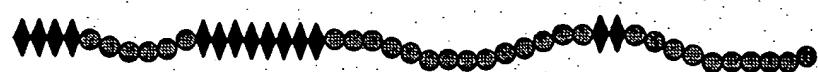
FIG. 3



Star Copolymer

FIG. 4

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Multi-block Copolymer

FIG 5A



Multi-block Copolymer

FIG. 5B

INTERNATIONAL SEARCH REPORT

Intern. Appl. No.
PCT/US 99/24840

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C08K5/103

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C08K A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 91 05014 A (RAYCHEM LTD) 18 April 1991 (1991-04-18) claim 1; examples A,B	1,3, 7-11,19, 20,23,24
X	US 5 412 022 A (ANDRES JOHANNES ET AL) 2 May 1995 (1995-05-02) column 3, line 25-61; examples 1,2 column 4, line 15-20	1,3, 7-15,20, 23,24
X	EP 0 210 655 A (NIPPON STEEL CHEMICAL CO) 4 February 1987 (1987-02-04) claims 7,8	1,3,5,7, 19
A	EP 0 147 146 A (AMERICAN HOME PROD) 3 July 1985 (1985-07-03) claims; examples	1-10

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

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A document member of the same patent family

Date of the actual completion of the International search

Date of mailing of the International search report

15 February 2000

24/02/2000

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Friederich, P

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/24840

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9105014 A	18-04-1991	AT 133987 T		15-02-1996
		AU 638287 B		24-06-1993
		AU 6508190 A		28-04-1991
		CA 2065730 A		06-04-1991
		DE 69025331 D		21-03-1996
		DE 69025331 T		10-10-1996
		EP 0494936 A		22-07-1992
		JP 2971133 B		02-11-1999
		JP 5500976 T		25-02-1993
		US 5442004 A		15-08-1995
US 5412022 A	02-05-1995	DE 4039899 A		17-06-1992
		AT 138086 T		15-06-1996
		DE 59107825 D		20-06-1996
		DK 561843 T		14-10-1996
		WO 9210537 A		25-06-1992
		EP 0561843 A		29-09-1993
		ES 2086555 T		01-07-1996
		JP 6503105 T		07-04-1994
EP 0210655 A	04-02-1987	JP 1444042 C		08-06-1988
		JP 62030140 A		09-02-1987
		JP 62054819 B		17-11-1987
		DE 3682454 A		19-12-1991
		US 4742102 A		03-05-1988
EP 0147146 A	03-07-1985	AU 3683484 A		27-06-1985
		CA 1238275 A		21-06-1988
		DK 626384 A		23-06-1985
		GR 81250 A		19-11-1985
		HU 37040 A		28-11-1985
		JP 60152413 A		10-08-1985
		KR 8900183 B		09-03-1989
		US 4931283 A		05-06-1990
		US 4933184 A		12-06-1990
		ZA 8409780 A		27-08-1986